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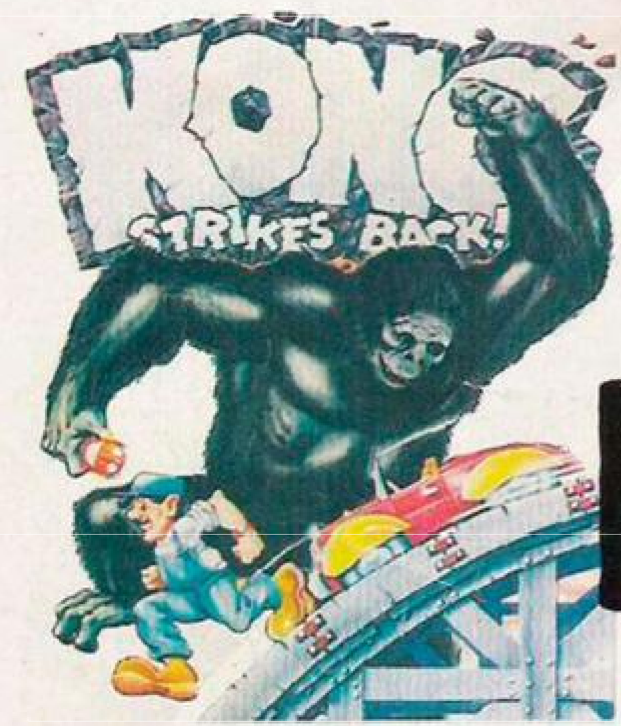

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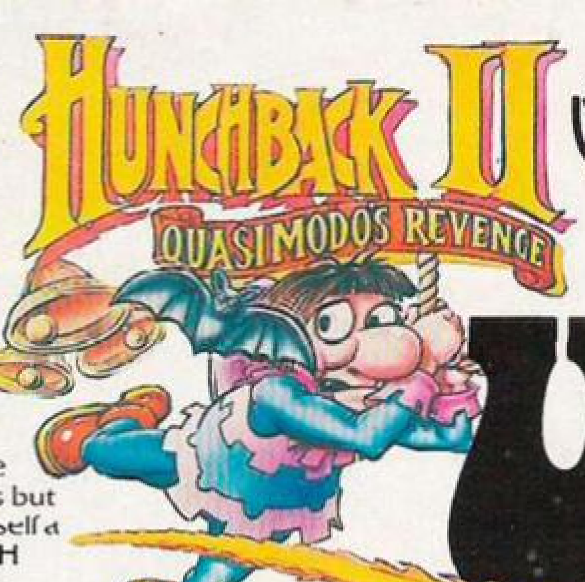

and the Ughly!

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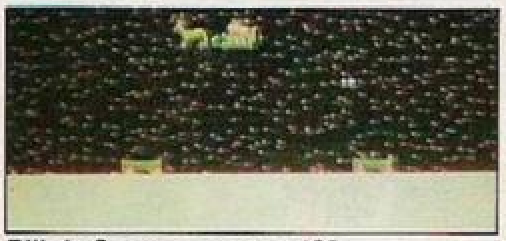
Telsoft downloading service: page 64.

Yamaha CX-5M review: page 72.



Bill da Snowman: page 126.

BBC Darts: page 148 also on Telsoft.

Cover shot: Rediffusion simulator — see pages 90 and 91.

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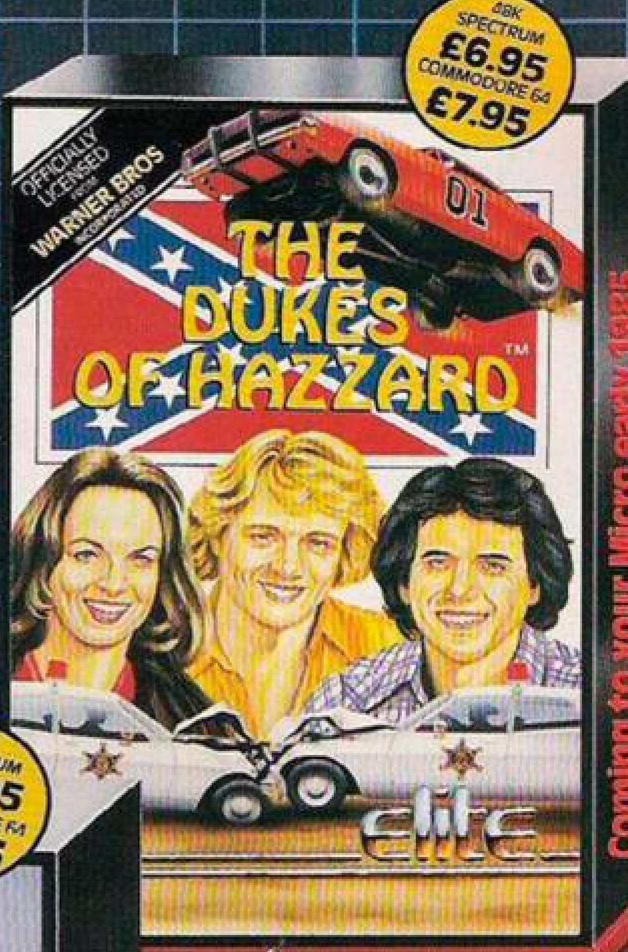

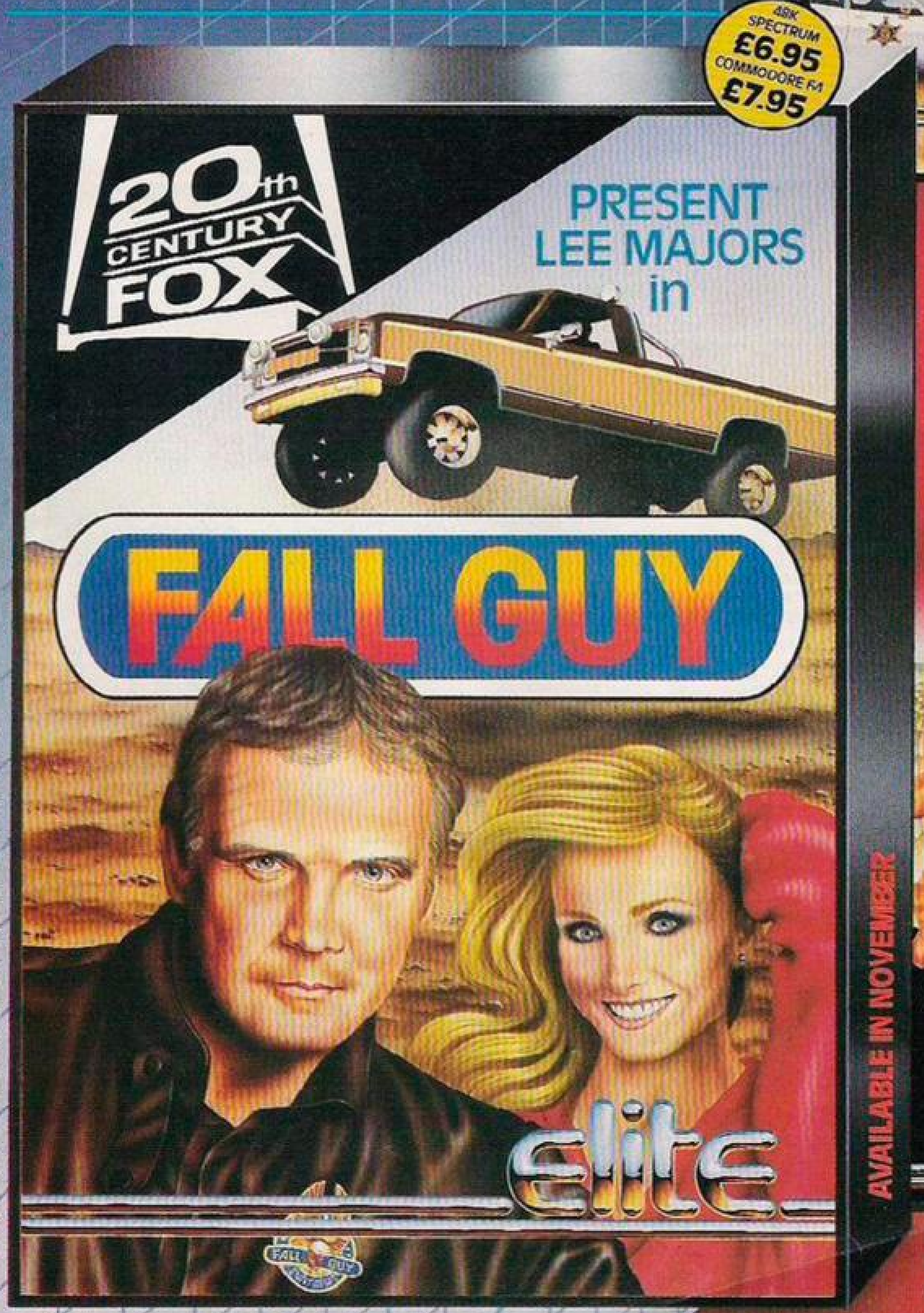

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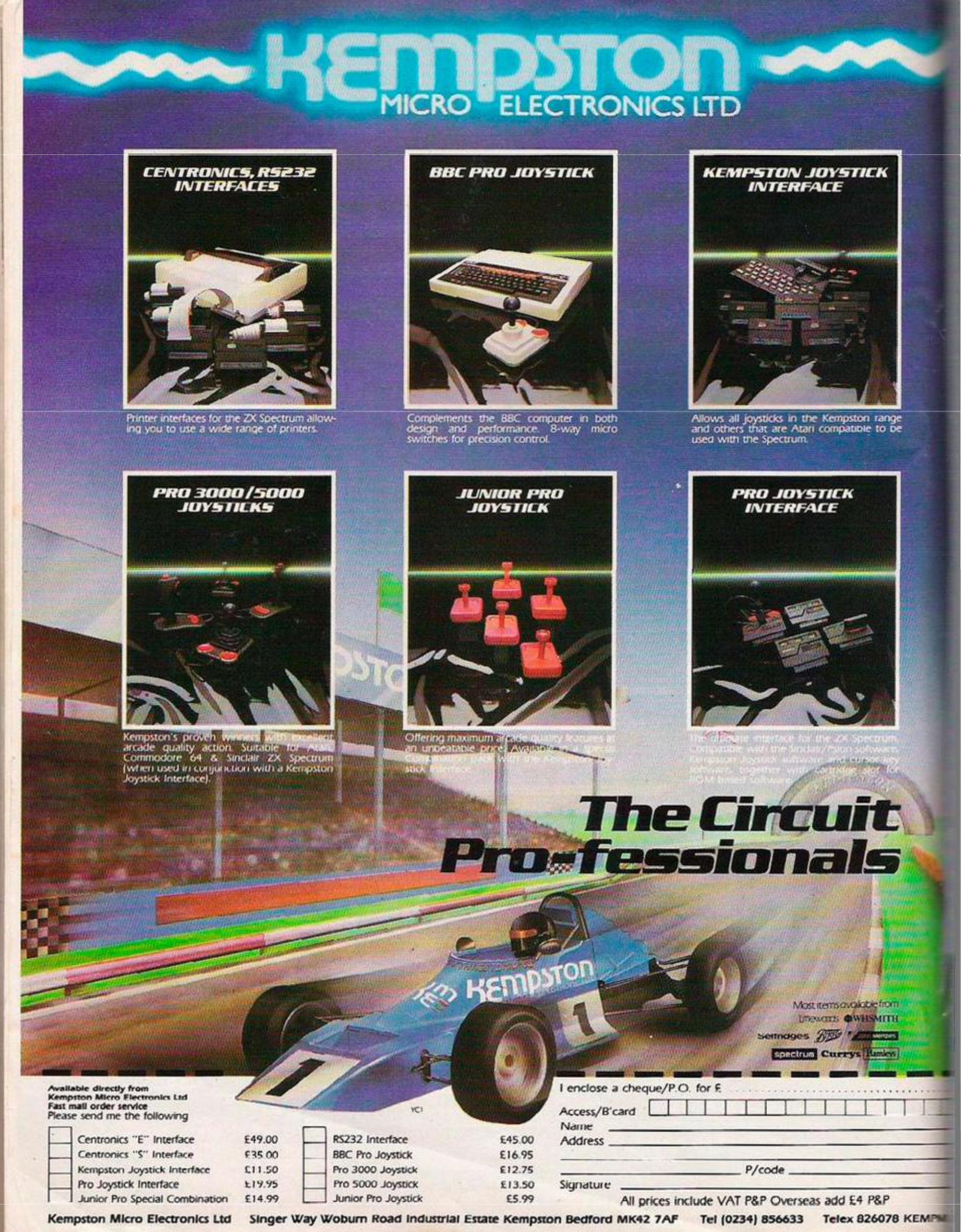

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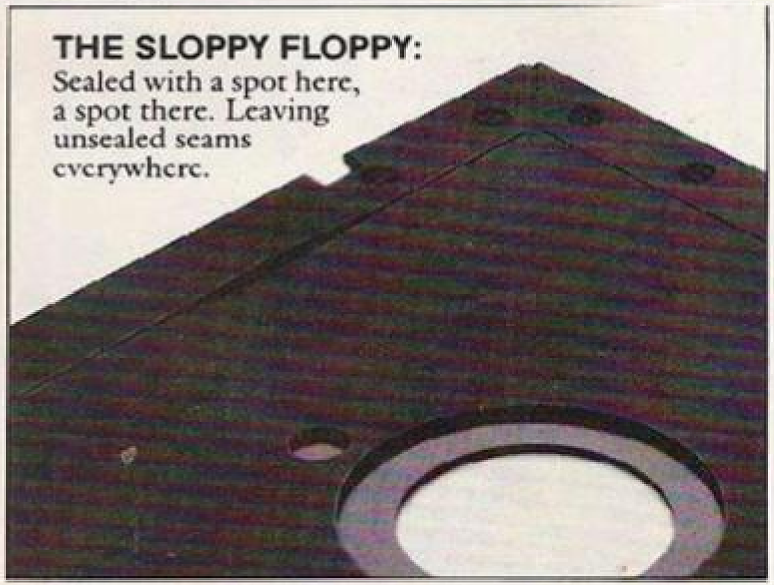

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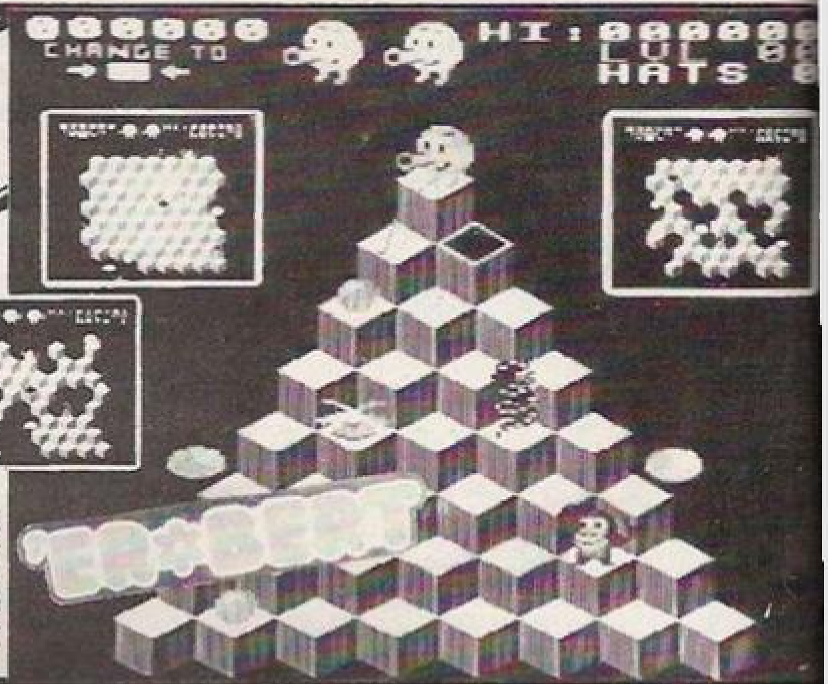

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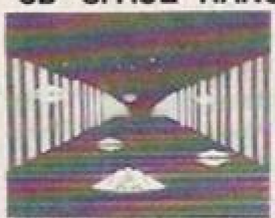

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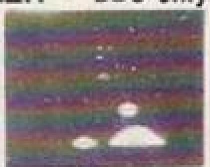

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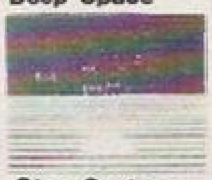

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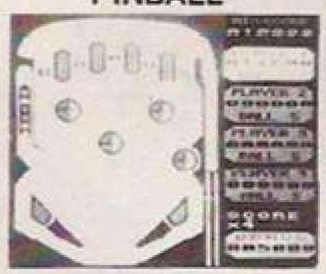

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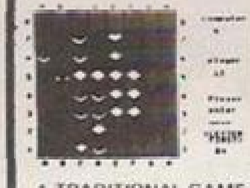

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the MIDAS adventure concept

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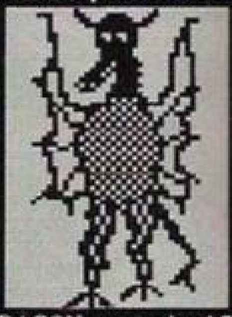

DRAGON *power level 7 — 9*

LYTCH *power level 6 — 10*

WEREWOLF *power level 4*
a selection of your opponents

PSS

SWORDS & SORCERY

Swords and Sorcery represents the first example of the ultimate in graphic adventures using the unique MIDAS system.

Swords and Sorcery differs from other adventures in that you guide your character through the unending corridors of the underworld on a quest for material, physical and/or spiritual power. The choice is yours.

You begin as a novice with limited abilities in the use of magic, sword play and stealth (lock picking, thieving etc).

As you wander the corridors, you will encounter beings meek and mighty, discover untold wealth and worthless trash. Some objects will increase your powers, whilst some will be dangerous and still others will be protected from pilferers (you!) by friendishly ingenious traps, all designed to help or hinder you on your pilgrimage to power and glory.

There are quests within quests within Swords and Sorcery, for those who want to follow them. Some are given others must be found, and some are lost causes. There are many ways of opening the gate between the levels of the dungeons. Some are obscure and easy, others obvious and dangerous. The most profitable paths are both. The Ultimate goal of many will be to find the lost armour of Zob, which was un-made by its maker, and its parts scattered across the levels. What, where, how, who and why are answers to be found. All that is known is the prayer of the seekers:

WHEN DARK CABALLUS HIS COUNCILS LEND US
LET NOT THE RED CLUPEA HARANGUE US
TURN US FROM WHAT SEEMS TREMENDOUS AND
THUS TO ZOBS GREAT TREASURE SEND US.

You need never tire of Swords and Sorcery — when this dungeon can no longer hold you, the next awaits. . . there are a series of expansion modules planned to extend your enjoyment indefinitely.

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(Multi Dimensional Animation System)

MIDAS ADVENTURE CONCEPT

Stunning 3D graphic animation simulating video disk games.

A unique fully interactive adventure language using the latest ARTIFICIAL INTELLIGENCE techniques.

State of the art data compression techniques enabling enormous scenarious and vocabularies to be incorporated.

Real time Interactive Conflict Sequences.Talk to your opponent, attack them, flee them and even confuse them.

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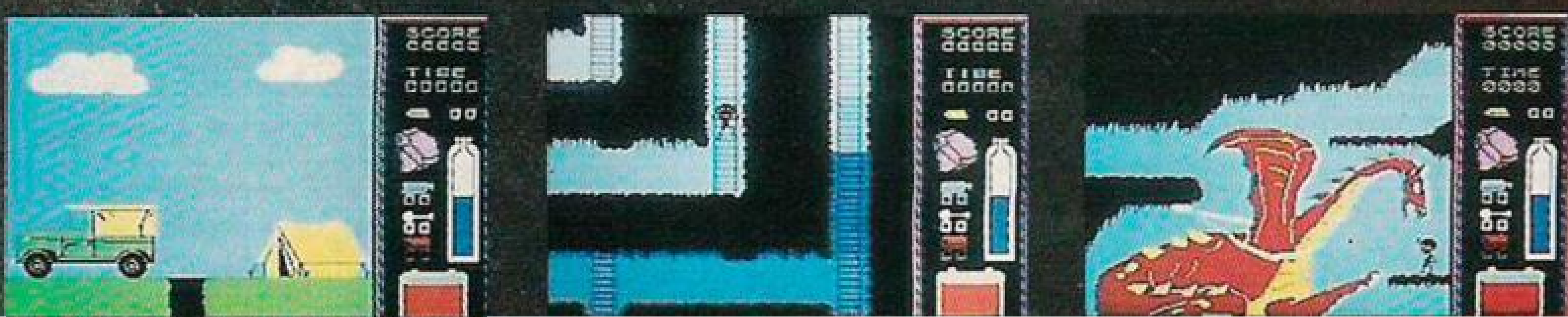
Death pit takes you deep down
to a tangled labyrinth of dank tunnels.
Struggle through spider infested corridors,
past bats and mutant life forms.
Dig through the rockfalls
(you remembered a spade?)
and bravely plunge into the dark water
of flooded caverns.

The tension grips,
your pit light fades
and before you waits the Guardian.
After this last gruesome trial
will you still have strength enough
to return?



screen shots from Spectrum 48K.

Sounds tricky? – well it is . . . . . and we haven't
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game from Durell.
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Death Pit

from
DURELL – a touch better than the rest

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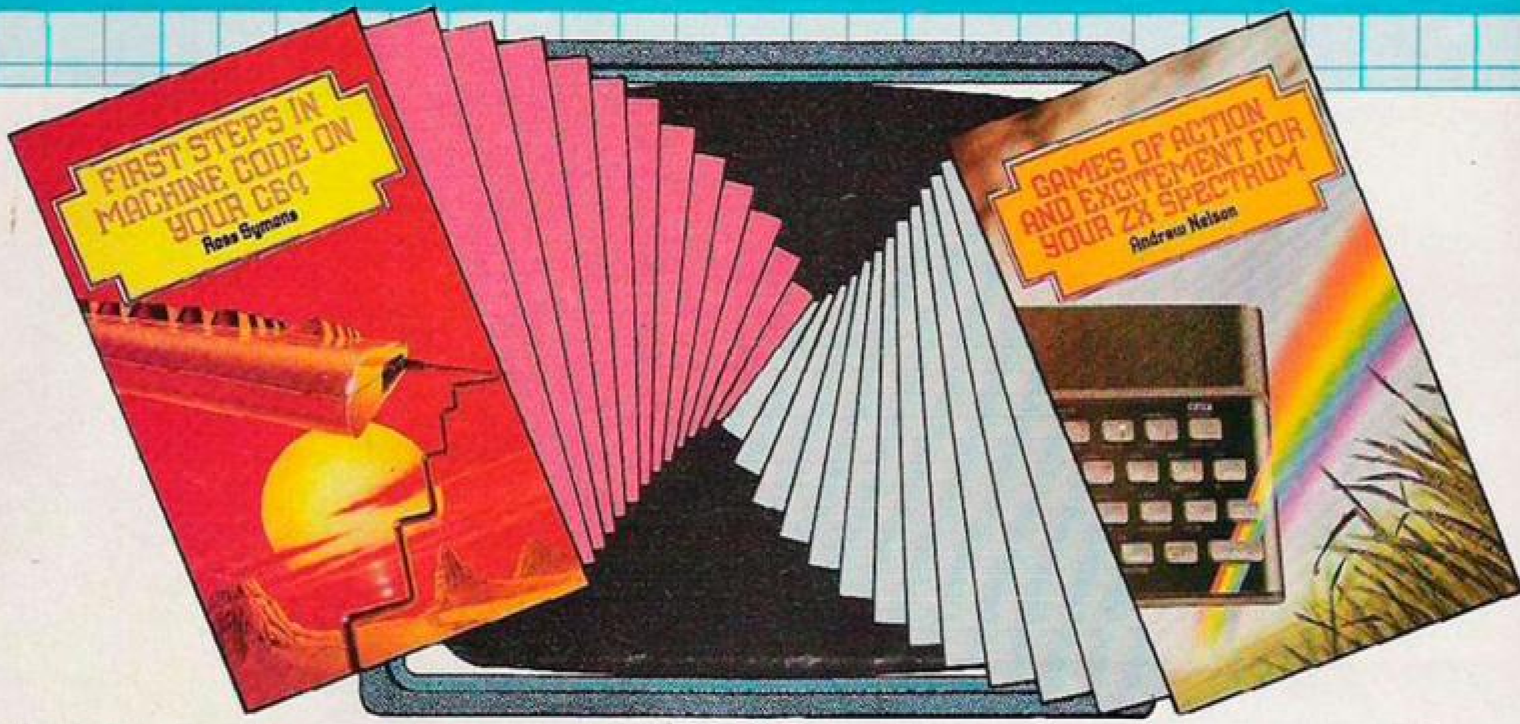

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FORT APOCALYPSE
BLUE MAX
ATARI
64
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You're at the controls for this World War I dogfight game.
Shoot down enemy planes, bomb targets, strafe tanks and gun emplacements – there's constant action on the incredible 3-D diagonally scrolling screen. At the same time, you have to keep track of altitude, speed, fuel and damage. Medals don't come easy. You must master a series of flying skills and perform them with pinpoint accuracy. One slip and you've lost it all – even your life. Happy landings, ace!
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Exciting 3-D action! The most realistic point-of-view game you've ever played. Navigate through asteroid belts, destroy enemy ships, and more!
Commodore 64.

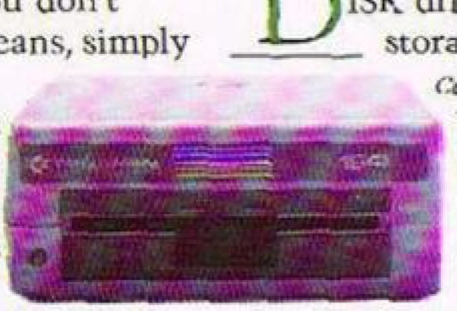
Home computers.

The report you've been waiting for: simple, factual, honest, comprehensive and 100% biased.

ALL you need to know about computers can be summed up in one word: Commodore. (Well, we did tell you this would be biased).

We make everything you'll ever need to get the most out of home computing: all the *hardware* and all the software. (And if you don't understand what that means, simply look under "H").

That's what these three pages are all about: explaining what computers are (without the scientific jargon), how they work (without any technical *mumbo-jumbo*), and how you can get more enjoyment out of them (without much difficulty).



BASIC. Most home computers speak the same language. It's called BASIC. This is a more friendly way of saying "Beginners All-Purpose Symbolic Instruction Code."

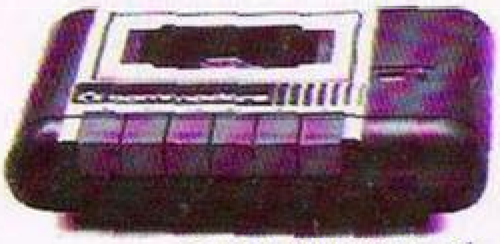
There are different kinds of BASIC and, like languages, some are a little easier to understand than others. *Like, BASIC 3.5 in the Commodore Plus/4* and *Commodore 16.*

BOOKS you can read: "Teach Yourself Computer *Programming* With The Commodore 64" and "Programmers Reference Guide."

CASSETTE. Just as you keep your favourite music on cassette, so you can also keep your *favourite* computer programs on cassette.

You can either buy pre-recorded programs in a shop, or you can write them yourself. Cassettes are just one form of program storage and playback – see also *Cartridges* and *Disk Drive.*

To play cassette software you need a cassette unit. The Commodore 1530 and 1531 cassette units have been specifically designed to get the very best out of our computers, and provide consistently reliable results.



CARTRIDGES. These are programs that plug directly into the back of the computer itself.

CPU stands for Central Processing Unit. This is the computer's "brain," and as such it's what does all the hard work.

CHIP: silicon. A very complex electrical circuit miniaturised in silicon. It carries out the functions in *the computer.* Unlike other home computer companies, we make our own chips, so maintaining quality.

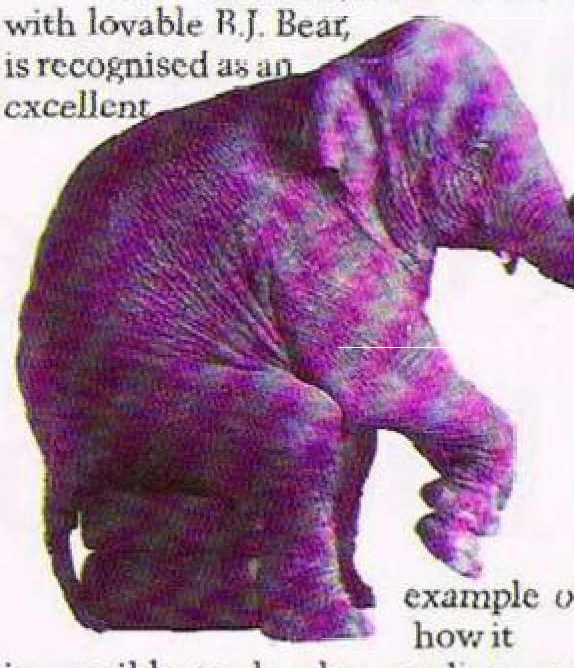
DISK drive. A program and data storage system, just like *cassettes, but much faster.* You can find and load *the program you're looking for in seconds* instead of minutes.

Diskettes, which can be used repeatedly for *recording* or re-recording programs, transfer information or instructions to and from the computer.

EDUCATION software from Commodore. We work non-stop with educationalists, improving our range of programs *for the pre-school to* "O" level age groups and beyond.

Computers are an invaluable educational tool – versatile, patient and able to present information in an exciting way.

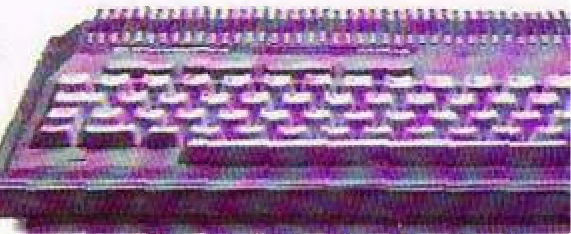
Our "Get Ready to Read" series, with lovable B.J. Bear, is recognised as an excellent



example of how it is possible to develop reading and writing skills *in pre-school children.*

ELEPHANT: well-known symbol of the *Commodore* 64's enormous 64K memory. And *don't you forget it!*

FOUR is for Commodore Plus/4, our very latest home computer with four, very popular built-in programs: wordprocessing, spread-sheet (financial planning), database (filing), and graphics.



It has an extensive 64K me[...] with an exceptionally large 60K available for use. The Plus/4 c[...] equipped with the Commodore BASIC 3.5 with over 75 program[...] commands.

Other features include s[...] facilities, comprehensive grap[...] and 121 colours.

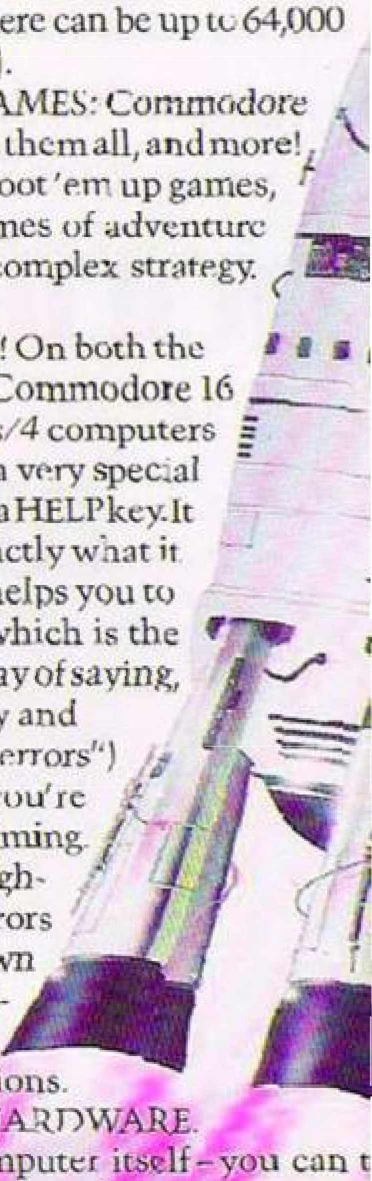
GORTEK and the Microchip[...] unique programming c[...] for children of all ages, links learning exercise[...] with a space adventure[...] GRAPHICS.

The pictures and diag[...] on a *monitor* or TV scree[...] either high or low resolu[...]

All *Commodore* ho[...] computers have 62 gra[...] symbols to create low resolu[...] *pictures and diagrams, or* high resolution modes th[...] allow you to specify each pixel (or dot) on the screen.

(There can be up to 64,000 of these).

GAMES: Commodore produce them all, and more! From shoot 'em up games, to games of adventure and complex strategy.



HELP! On both the Commodore 16 and *Plus/4* computers there is a very special feature: a HELP key. It does exactly what it says: it helps you to debug (which is the smart way of saying, "identify and correct errors") when you're programming.

It highlights errors right down *to* individual instructions.

HARDWARE. The computer itself – you can t[...] it. Whereas software's a progran[...] *can only see or hear* (on the mo[...] when it's running in the comput[...]

INTEGRAL software is software that is actually built into the computer, as on the Commodore *Plus/4*, the very latest in home computing.

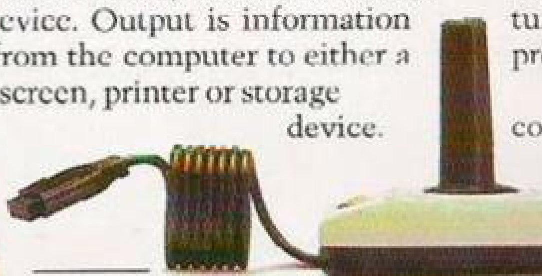
INTRODUCTION to BASIC. Just as you don't need to understand how a car works to be able to drive it, you don't have to understand how a computer works to be able to use one.

But you will definitely get more enjoyment out of it if you do have a basic knowledge of programming.

Which is why "Introduction to BASIC" has become the most popular software tutorial.

It comprises 2 cassettes and an easy-to-follow, step-by-step manual.

INPUT/output: Input is information put into the computer from either the keyboard or a storage device. Output is information from the computer to either a screen, printer or storage device.



JOYSTICK and paddles. As well as improving speed and accuracy, these make games more real by putting the control of whatever it is on the screen directly into your hands.

KILOBYTE is 1,024 bytes. So "K" stands for a unit of 1,024 or 2^{10}. A 64K byte memory unit contains 64×2^{10}, or 65,536 bytes of memory. And if you don't understand all that, don't worry.

All that's important is knowing you can run more complex programs through a computer with a large memory, than one with a small memory.

LANGUAGE. This is a system of coding that can be understood by a computer. It allows you to "speak" to the computer, and for the computer to "speak" to you. Most home computers speak *BASIC*, but there are also other languages available for Commodore computers that have been designed for specific uses.

For example, LOGO and PILOT in *education*.

MONITOR: this is the screen on which you can see what you've typed into the computer, and also what the computer is saying back to you. You can use an ordinary TV screen, but more preferable is a colour video monitor, like the Commodore 1701.

This is a special device that produces much higher resolution than a TV, and so offers superb reproduction and clarity.

On top of which it allows the rest of the family to stay tuned in to their favourite TV programme while you're tuned-in to your favourite computer program.

MODEMS allow computers to connect via a telephone line to other computer systems. Commodore 64 modem owners can communicate with other owners, join systems like Prestel/Micronet and an exciting new system called Compunet, where quality software is available cheaply or even free.

MEMORY. There are two basic types of memory: ROM and RAM.

Read Only Memory (ROM) is the computer's permanent built in memory which tells the computer what to do. It doesn't disappear when the computer's switched off.

Random Access Memory (RAM), however, is for temporary storage.

It is the part of the computer's memory that's free for you to use. It can be erased and used over and over again.

It stores both data and instructions during the execution of a computer program. These are lost when you switch the machine off – unless, of course you store them on *cassette* or *diskette*.

NUMBER ONE. In the whole wide world, Commodore is No. 1 in microcomputers, and the Commodore 64 is the No. 1 best seller.

ORIGIN of the computer. In the 19th Century an Englishman, Charles Babbage, invented the first true computer. But his "Analytical Engine" was so ahead of its time, it turned out to be impossible to build!

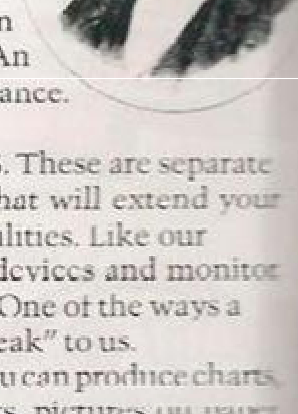
The modern computer first appeared around the time of World War II. Britain's "Colossus" was vast, consumed vast amounts of electricity, required its own air-conditioned room, was unreliable and difficult to operate.

It had its limitations.

Then came the amazing transistor... integrated circuits... and microcomputer.

The first desk top microcomputer in the world was the Commodore PET (this was a friendly name for Personal Electronic Transactor), in 1977.

In effect Commodore had taken hitherto huge, expensive, mysterious machines accessable only to eggheads, reduced the size and price, and put them into the hands of ordinary mortals in ordinary offices. An extraordinary advance.



PERIPHERALS. These are separate add ons that will extend your computer's capabilities. Like our printers, storage devices and monitor.

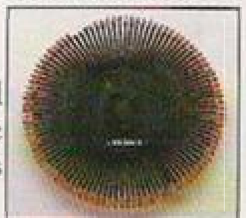
PRINTER: One of the ways a computer can "speak" to us.

It means you can produce charts, letters, documents, pictures on paper

The Commodore range includes four printers and one printer plotter.

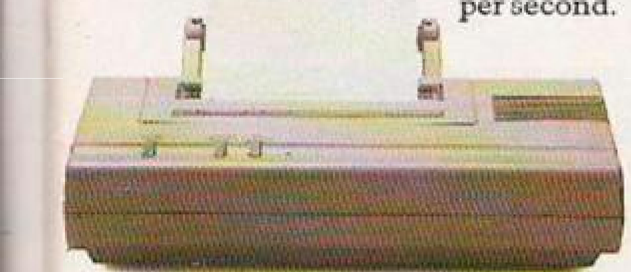
The MPS 801 dot matrix printer (so called because its characters are made up of dots) has a print speed of 50 characters per second, about five times as fast as the fastest secretary.

The MPS 802 dot matrix friction feed printer has a print speed of 60 characters per second and uses either single sheets or continuous stationery.



The DPS1101 daisy wheel printer (called that because, surprise, surprise, the print wheel looks a bit like a daisy), produces superb quality print on all letters, reports and documents (the kind of quality one desperately requires on a letter to the bank manager). There's a range of alternative type faces available on additional print wheels. Speed: 18 characters per second.

And the 1520 printer plotter (illustrated). This has 4 colours, and opens up a whole new world of graphic print-out ability. You can draw pictures, create graphic designs, plot graphs or construct bar and pie charts. Speed: 14 characters per second.



QWERTY – the 6 keys at the top left hand side of a standard typewriter. Unlike lesser machines, all Commodore computers have full-size, professional typewriter keyboards.

They have a solid, responsive feel to them. (The problem with rubber or membrane keyboards is they have a soft, spongy feel to them: you press a key, then wonder if the message got through).

RANGE. The range of Commodore software is enormous. There is something, as they say, for everyone: educational, business, home and games.

STARTER PACK. The Commodore 16 Starter Pack has been specially designed to introduce you to computing.

It contains everything you need to start home computing, complete in one box: a 16K computer, *cassette* unit, four superb software programs, and Introduction to *BASIC* Part 1.

It has a *Help* key in case you get into difficulties, and incorporates advanced *BASIC*, which has been specifically designed to simplify the programming process.

Other features include: 4 cursor keys, 2 *joystick* ports, an astonishing 121 colours, plus excellent sound and *graphics* capabilities.

TUNES. Commodore make software to help you compose your very own music.

All our home computers have great sound and music capabilities.

USER friendly. This is a program that explains itself as it goes along, or a computer that people can easily operate.

Every computer manufacturer now claims its products are "user friendly," but only Commodore really demonstrates it. For example, our *Help* key and use of Advanced *BASIC*.

VERTICAL integration is not as complicated as it sounds. All it means is that Commodore make everything to do with computers, from the silicon *chip* to the computer casing.

So we have complete control over everything, from design to manufacture.

It also means, of course, that we can design everything so you're able to get the very best out of your Commodore computer system.

WOMEN also are discovering computers – and not just in offices, but at home. Computers aren't sexist. They were invented for everyone, and the fact that they're fun, exciting, educational, practical and time-saving are benefits that apply to women just as much as to men.

XMAS. There is no better time to give or receive a Commodore present.

YIPPEE! Yes, now you know (or should do) that computers are really interesting. They're not just about space games with horrendous monsters. Nor are they horrendously complicated machines that you need a maths degree to understand.

Computers are the future, and it's important that you and, even more so, your children don't get left behind in the past.

With a Commodore computer and a *peripheral* or two (and we now know what those are, don't we?) whole new leisure and business opportunities will immediately be opened to you.

Make the choice now and (just so long as it's Commodore) we promise you will never regret it.

ZIP us a line if you'd like more even more biased information on any Commodore products.

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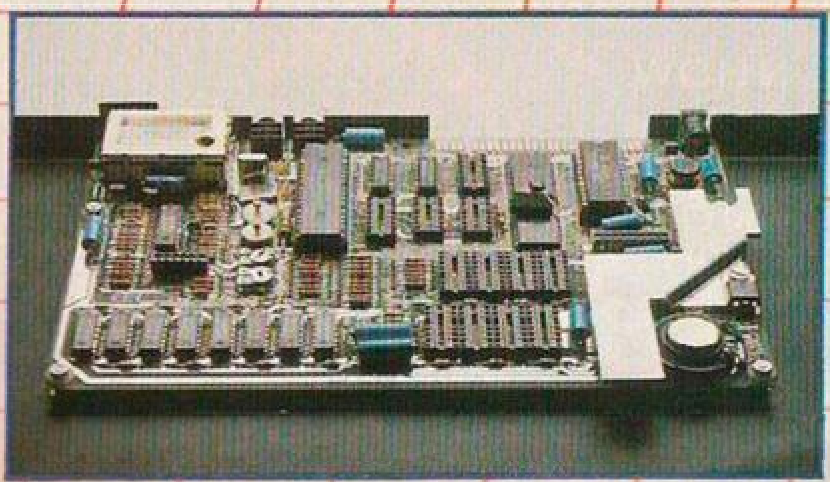

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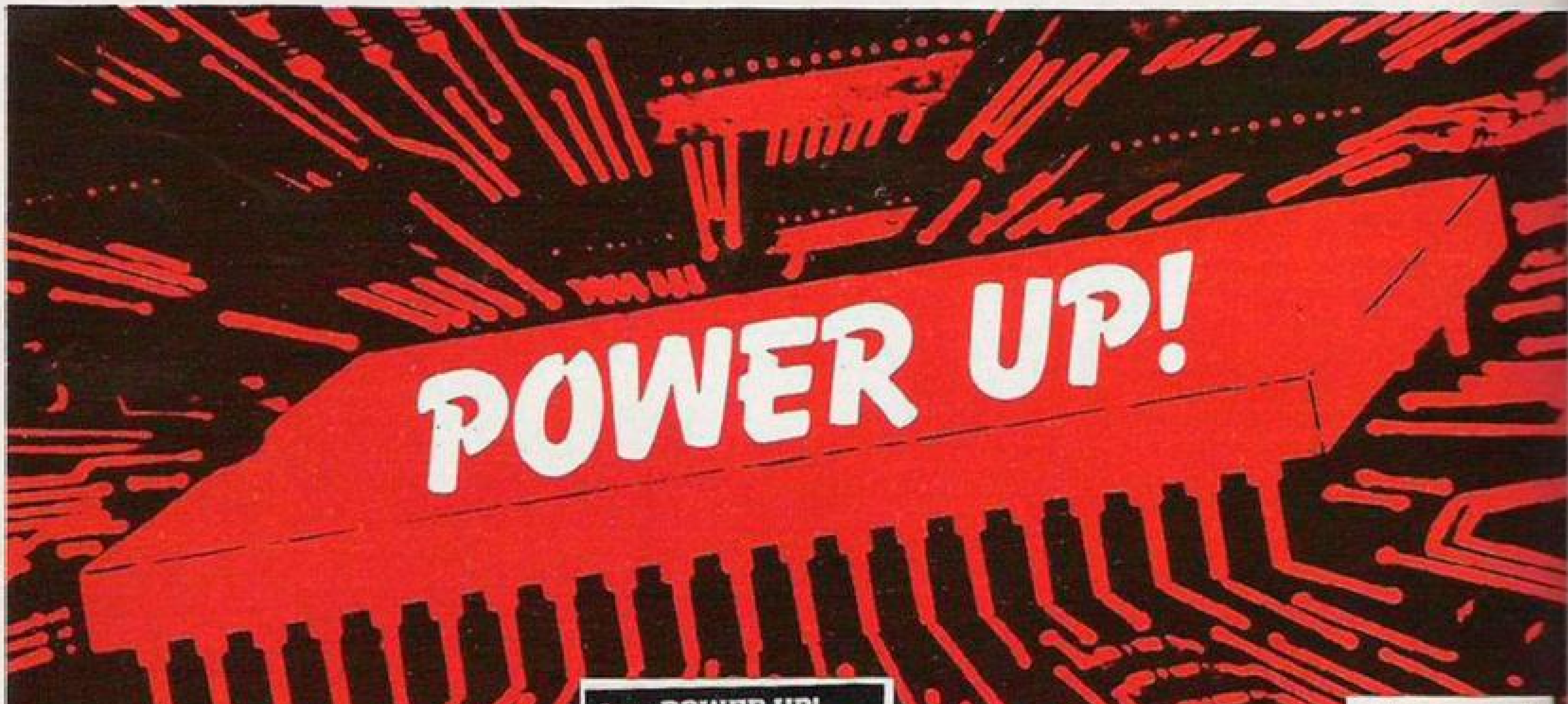

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Your Second Commodore 64 Program

G. Lippman £8.95

The many colorful illustrations in this book make it a delight for children and fun for adults who are mastering BASIC programming. A sequel to **Your First Commodore 64 Program,** the book follows the same thorough, detailed approach and brings you to the next level of programming skill. With these BASIC language techniques, you'll soon be creating your own applications!

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You can use this practical set of programs without any prior knowledge of BASIC! Application examples are taken from a wide variety of fields, including business, home management, and real estate. Just type them in and they're ready to run!

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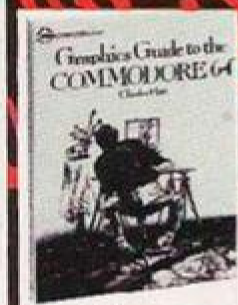
Power Up! Kids' Guide to the Commodore 64

M. DeJonghe/C. Earhart £7.95

Colorful illustrations and a friendly robot highlight this guide to the Commodore 64 for kids 8-11. The hands on approach features short, easy lessons, and the spiral binding makes it ideal for use right at the computer. The engaging exercises are full of surprises and discoveries. By the end of the book, kids will be programming their own guessing games, "all-purpose" thank you notes, multi-colored pictures, and simple animation. The authors are elementary school teachers with several years of computer experience.

ISBN: 0-89588-188-8, 9"x7", 192 pp, illustrated



Graphics Guide to the Commodore 64

Charles Platt £9.95

This easy-to-understand book is the first to answer the need for a Commodore-specific graphics guide. It will appeal to anyone who wants to master the Commodore 64's powerful graphics features. You'll learn to move images across the screen, built your own character sets, and create impressive headlines and detailed pictures on the screen. A full color collection of screen displays is included, as well as instructions on how to create your own video games.

ISBN: 0-89588-138-1, 7"x9", 261 pp, illustrated

Programming the 6809

Zaks/Labiak £11.95

Get more out of your 6809 microprocessor – this book is chock full of programming tricks to show you how. Start with the basics of assembly language programming, and go on to understand registers and buses, subroutines, the 6809 instruction set, addressing modes, I/O techniques and devices, data structures, and useful applications. Give your 6809 processor 16-bit performance with 8-bit economy. No prior programming knowledge is required.

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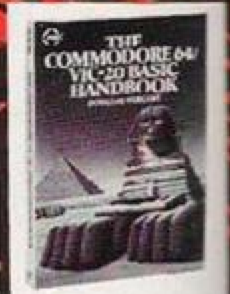

The Commodore 64/VIC-20 BASIC Handbook

D. Hergert £9.95

In this dictionary-style handbook, you'll find clear descriptions and examples of each word in the Commodore 64/VIC-20 BASIC vocabulary. The proper syntax of every keyword and function is explained carefully and thoroughly in easy-to-understand English. Short example programs illustrate the correct use of each command, and special notes provide insight into subtleties and extra features of Commodore 64/VIC-20 BASIC.

ISBN: 0-89588-116-[illegible], 6"x9", 185 pp, illustrated

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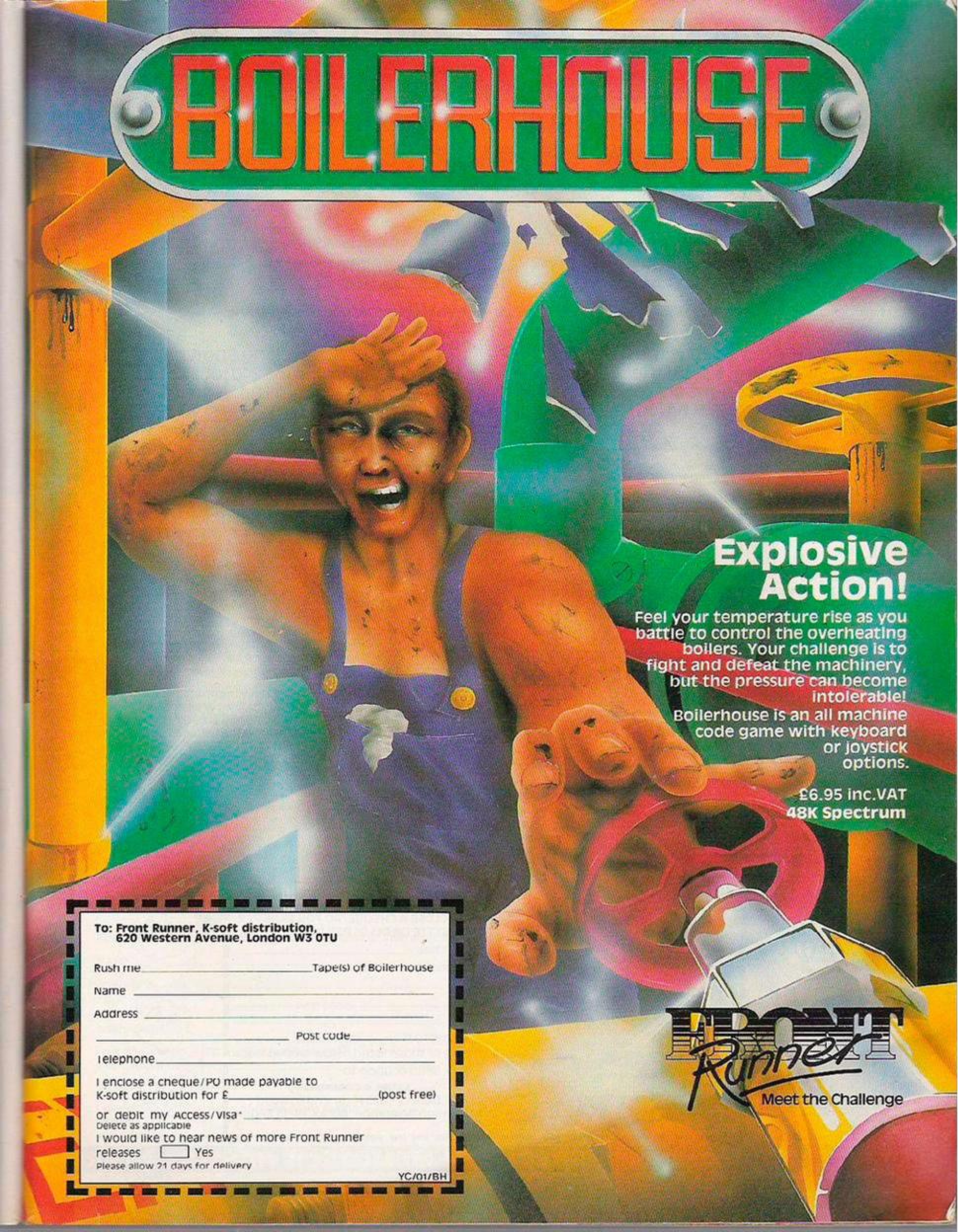

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– Computing Today, Aug 84

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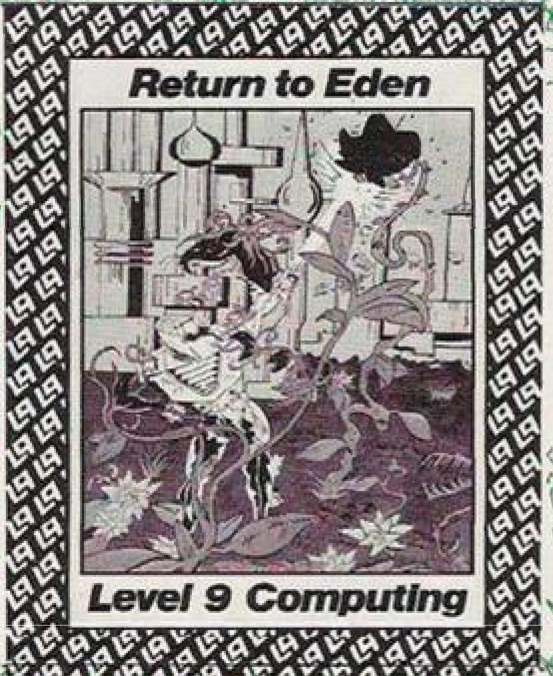
– Your 64, June 84

"Level 9 – arguably the producers of the best adventure games in the UK – have done it again. Lords of Time is a sparkling addition to its stable of winners."
– Acorn User, July 84



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"The Saga of Erik the Viking . . . a remarkable Adventure game. It carries all the hallmarks of a Level 9 Adventure – problem, text display and size of map – with graphics of a standard I have not yet seen before in an Adventure."
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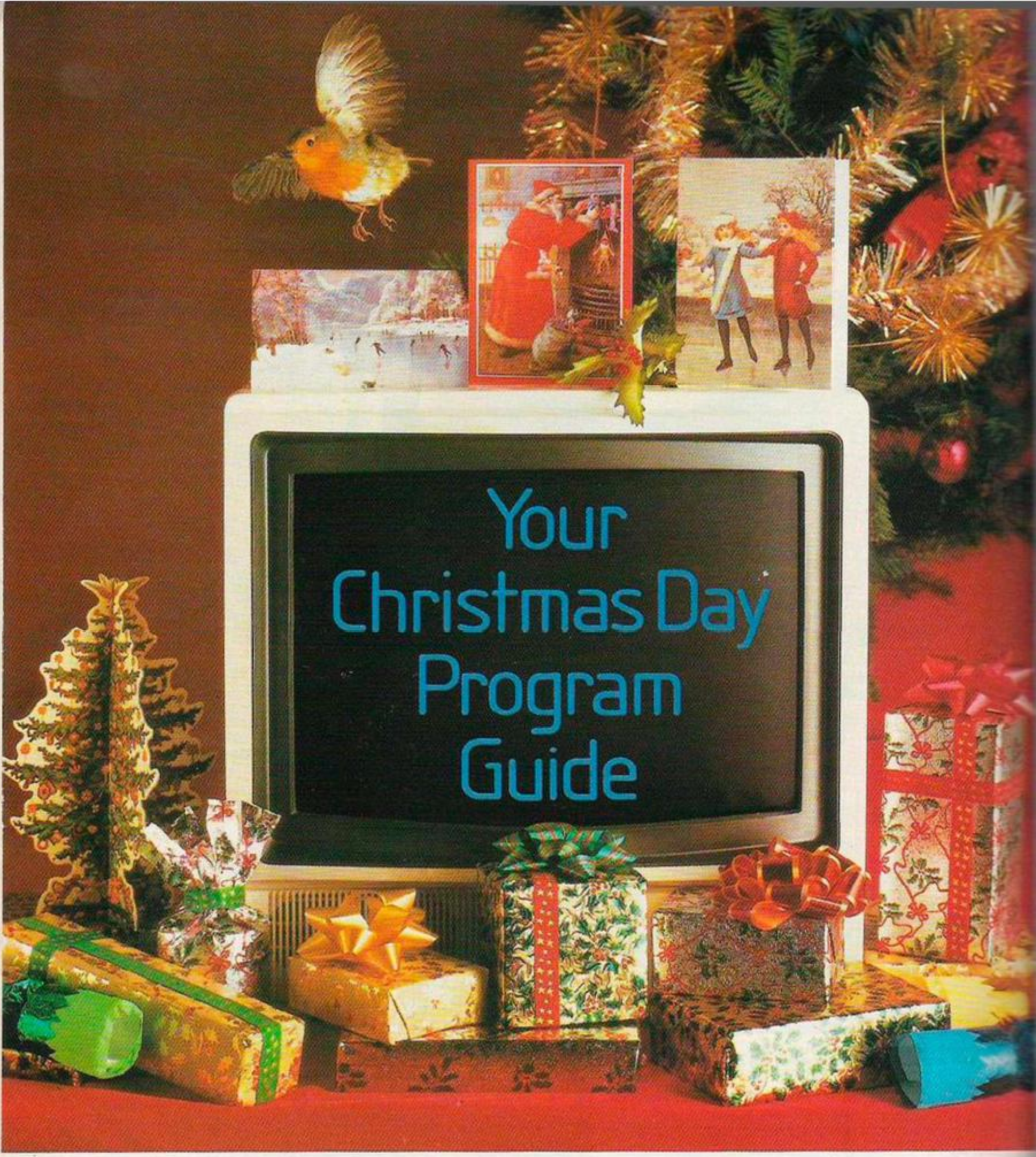

Acornsoft announce tidings of great joy for both BBC Micro and Electron owners: eight brand new programs for Christmas.

Each one makes an ideal stocking filler.

They're all available at your local Acornsoft stockist. For the address or to order by credit card simply ring 0933 79300.

Or you can send off for our catalogue by writing to Acornsoft, c/o Vector Marketi London Road, Wellingborough, Northa NN8 2RL.

Alternatively, however, you could always ta a chance and drop a line to Father Christmas.

ACORNS

Software for the BBC Micro and

9.00 Firebug

A fast moving arcade-type game in which you are a fireman, trying to rescue some oil drums and take them to the safety of a water tank. Your opponent is the firebug who runs around lighting fires which move slowly towards the drums and fire extinguishers, destroying them if contact is made.

10.00 Maze

A gripping graphics game where you enter a top secret installation with the aim of stealing secrets from a rival company. The security system, however, has many levels each consisting of a maze of corridors patrolled by armed robot guards. Complete with full colour 3-D graphics, sound effects and a high score table.

12.00 Elite

A superb 3-dimensional graphics game that's light years ahead of any other. You are a space trader who roams the universe, making your living from buying and selling cargo in your Cobra space craft. On your travels, you will encounter aggressors who are eager to put an end to your dealings. Be warned, only the fittest will survive.

1.00 Crazy Tracer

A crazy adventure in which you guide a paint roller round the edge of a maze of rectangles, while avoiding the monsters which are trying to stop you by crushing the roller. Beware – as the game progresses, so the number of monsters chasing you will increase.

3.00 Go

'Go' is a board game for two players which originated in China 3000 years ago and is now more popular than Chess in the Far East. It requires strategic insight, intuition and a strong, calculating mind. If you wish, you can also challenge the computer at differing degrees of difficulty. A velly good game indeed.

4.00 Watch Your Weight

At last, a weight-loss program designed especially for you. With it, your computer becomes an expert wholly conversant with and sympathetic to your needs, and will help you choose an appropriate and individual weight-loss plan. The program also includes a calorie counter and a series of apposite menu suggestions to help stimulate your imagination when you just can't think what to eat.

5.00 The Complete Cocktail Maker

With everything from a Black Russian to a Betsy Ross, this program contains data sufficient to concoct a staggering 320 different cocktails.

6.00 Paul Daniels' Magic Show

Stun and amaze your friends with your astounding feats of magic. This program contains ten tricks to be performed by or with your BBC Micro/Electron. Hurry though – it's bound to disappear fast.

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Sinclair's complete alternative to floppy discs...

The ZX Spectrum Expansion System contains:

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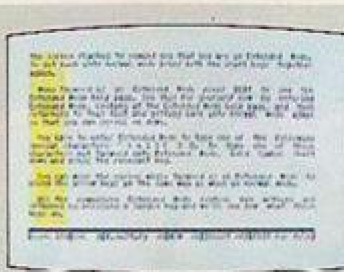
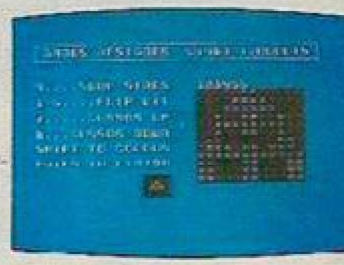
Tasword Two word processor



Turns your ZX Spectrum into a high-quality word processor!

Tasword Two has all the essential features of professional word processing packages – move and copy, insert, margin settings, 'help' pages, find and replace, and much more.
Written by Tasman Software Ltd.
Usual price (RRP): £13.90.

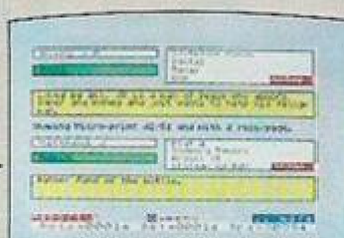
Games Designer



Now, all you need to create original games are original ideas – and Games Designer! It has eight, very different, pre-programmed games for you to play as they are – or modify out of all recognition!

There's never before been an easier, more enjoyable, way into games design.
Written by Quicksilva Ltd.
Usual price (RRP): £14.95.

Masterfile filing system



Address lists... personal files... stock inventories... stamp or album collections... club records... recipes ...if you can file it, you can Masterfile it!

Masterfile is a menu-driven filing and retrieval system of immense power. Display formats are user-defined, so the range of applications is enormous.
Written by Campbell Systems Ltd.
Usual price (RRP): £16.95.

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The all-time classic 3D strategy game. Ant Attack combines stunning Escher-like graphics with fast-moving action and a real tactical challenge.

Your task is to enter the walled city, seek out your captured partner, and escape. At all times you can choose from four angles of view. But beware: the city is patrolled by giant ants...
Written by Quicksilva Ltd. Usual price (RRP): £6.95.

All programs run on a 48K Spectrum or Spectrum +. Recommended retail prices are for each program on cassette.

...includes this great set of Microdrive programs!

The unique ZX Microdrive system sets the Spectrum apart from all other home computers.

It gives you all the advantages of floppy disc drives – at a fraction of the cost. And tests show the Microdrives are faster than some disc drives.

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This software alone would normally cost you over £50. Yet the Sinclair price for the complete ZX Spectrum Expansion Pack is just £99.95!

You'll find full details of its contents in the panel opposite.

ZX Microdrives–another Sinclair first!

The ZX Microdrive is a revolutionary fast access / mass storage device. And it's the only truly affordable alternative to disc drives ...

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- An RS 232 interface – to link your Spectrum with full-size printers, other computers using RS 232 (the industry-standard interface) and provide data transmission over telephone lines, via modems.
- ZX Net – lets you set up a local area network of up to 64 Spectrums, for high-speed data communications between you and Spectrum-owning friends.

At your local Sinclair stockist–today!

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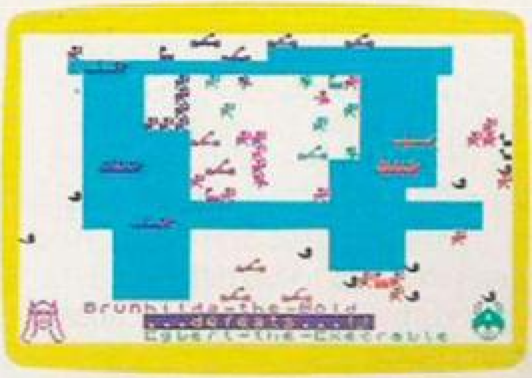

VIKING RAIDERS

THRILL to the Vikings' exploits in this highly original war game. SAIL the Fjord in search of treasure and adventure. LEAD your armies in raids on enemy castles. CURSE at the uncontrollable antics of drunken Norsemen. MAY ODIN PROTECT YOU! For 1, 2, 3 or 4 players (any combination of human and/or computer controlled Viking armies).

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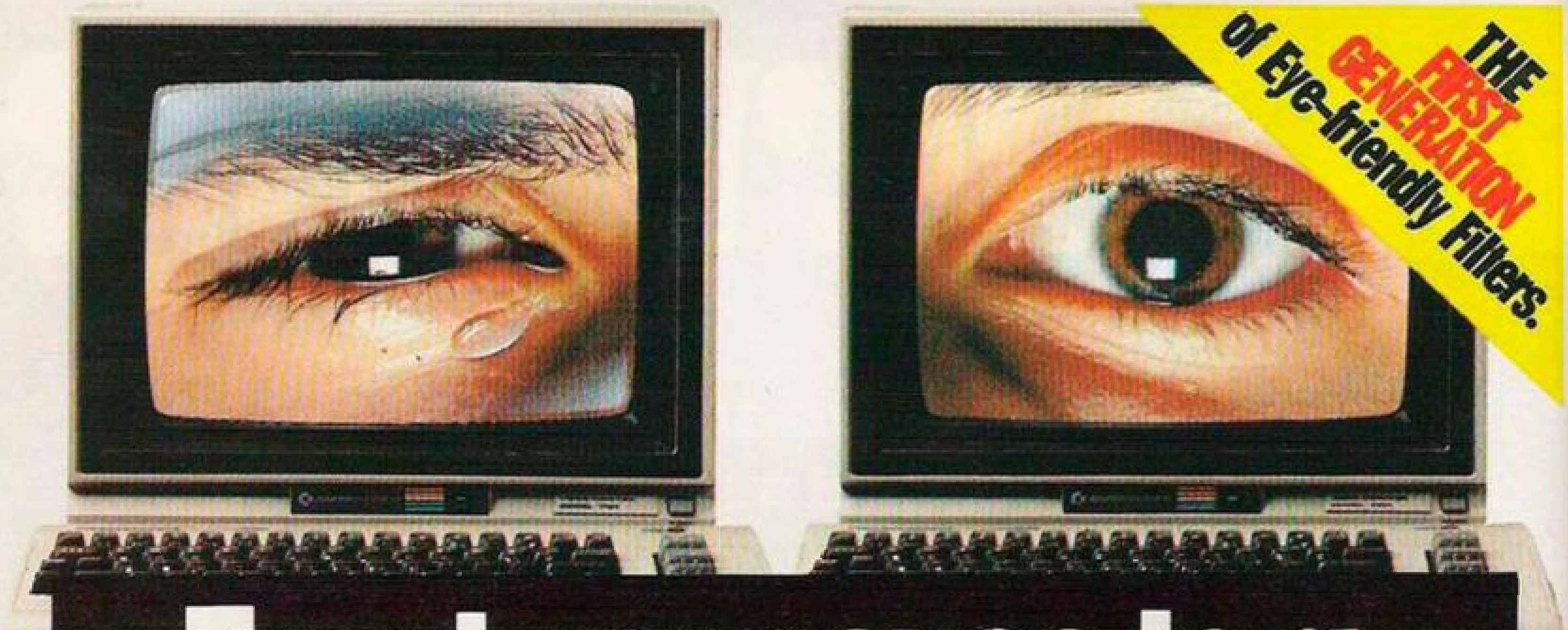

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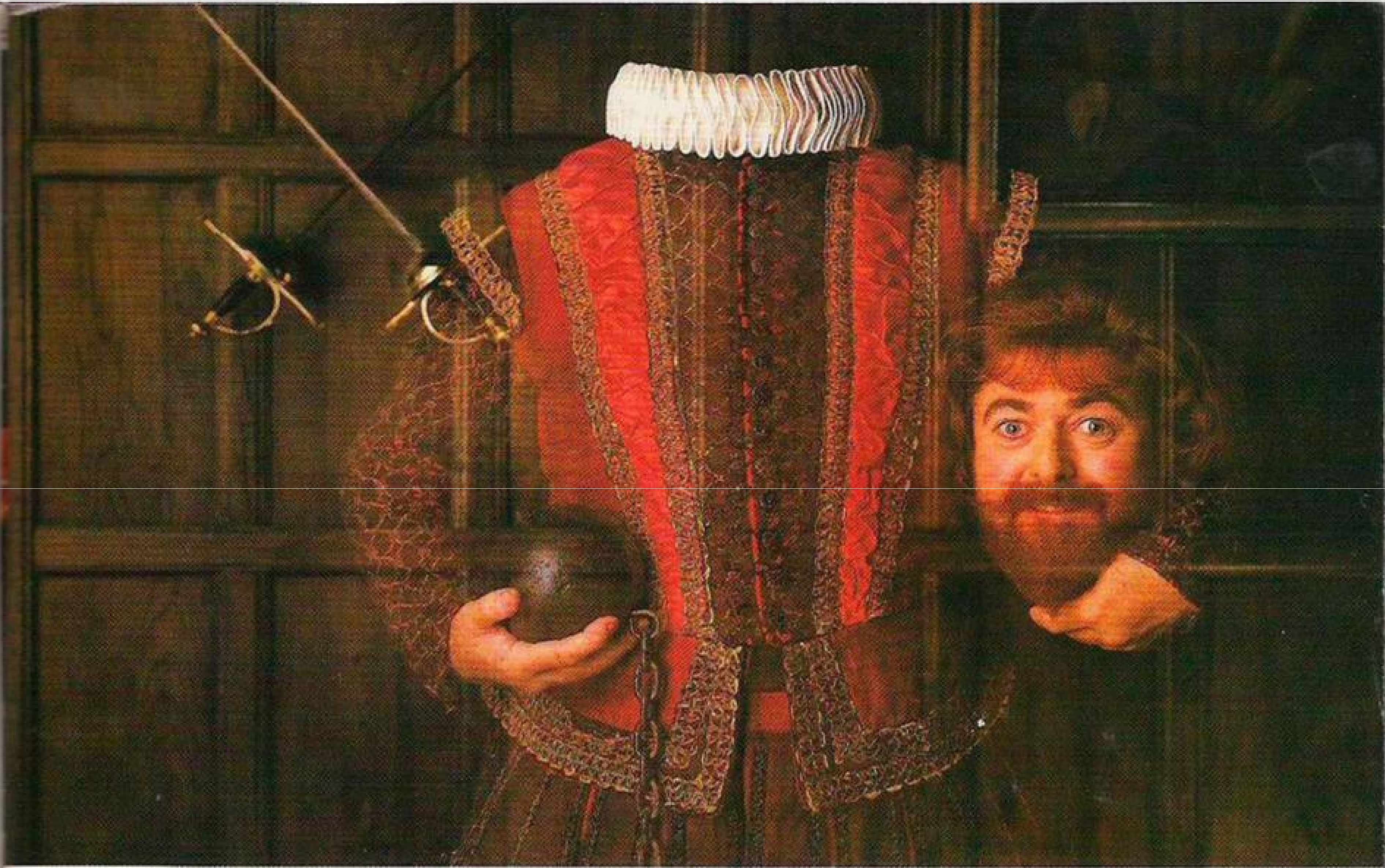

Education's a scream down at Spooky Manor.

Acornsoft have a range of education programs that encourage children to think logically and creatively. And at the same time, they make learning bags of fun.

SPOOKY MANOR: An adventure game for up to four players. Where exploring the creepy old house and solving mysteries involves co-operation and planning. It is suitable for children aged seven and upwards but many adults will enjoy the challenge it provides.

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TALKBACK: Both entertaining and demanding. It allows children to create their own computer 'characters' capable of holding simple conversations on the screen and provides valuable lessons in both English and computer literacy. For ages ten and over.

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For your local Acornsoft stockist or to order by credit card simply ring 0933 79300 during office hours. Alternatively you can order the programs by writing to Acornsoft, c/o Vector Marketing, London Road, Wellingborough, Northants. NN8 2RL, enclosing a cheque or postal order. Please allow 21 days for delivery.

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Not only is International Football startlingly life-like, but it gives you near perfect control over the players.

The ball's at their feet, and their feet are in your hands.

You can kick the ball and you can dribble it. You can pass it or even head it.

And every time you belt the ball into the net, the crowd cheers madly.

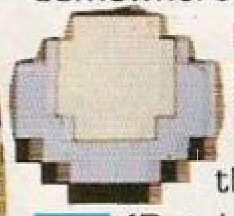
How often you score depends on how good you are. It also depends on the level at which you choose to play.

Altogether there are seven levels. From good amateur to... well, good professional.

You can choose the easiest level of play, so long as you don't expect a walk-over.

Or, if you fancy seeing what it's like to play in a Cup Final, then you can always choose the most difficult level.

Or play safe and choose somewhere in between.



At each level you're able to play either a friend or the computer.

(But be warned, it plays a pretty mean game does the Commodore 64).

You can also choose your team's colours, and those of the opposing team.

Which is great.

It means you can play for Chelsea one day, and QPR the next. Or Celtic, then Rangers.

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With International Football you get all the atmosphere of a Cup Final spectacular in your own front room.

The game is a real test of skill, dexterity and speed, and guaranteed to very quickly drive you football crazy.

Like all of our software, International Football has been designed to make the very most of our hardware.

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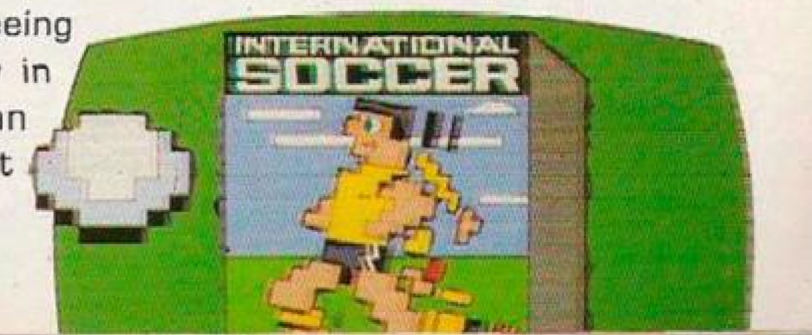

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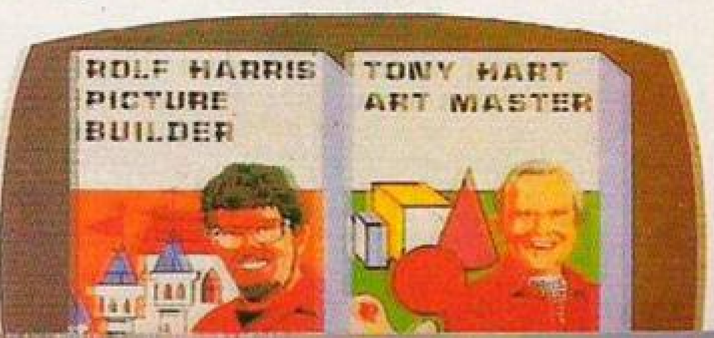

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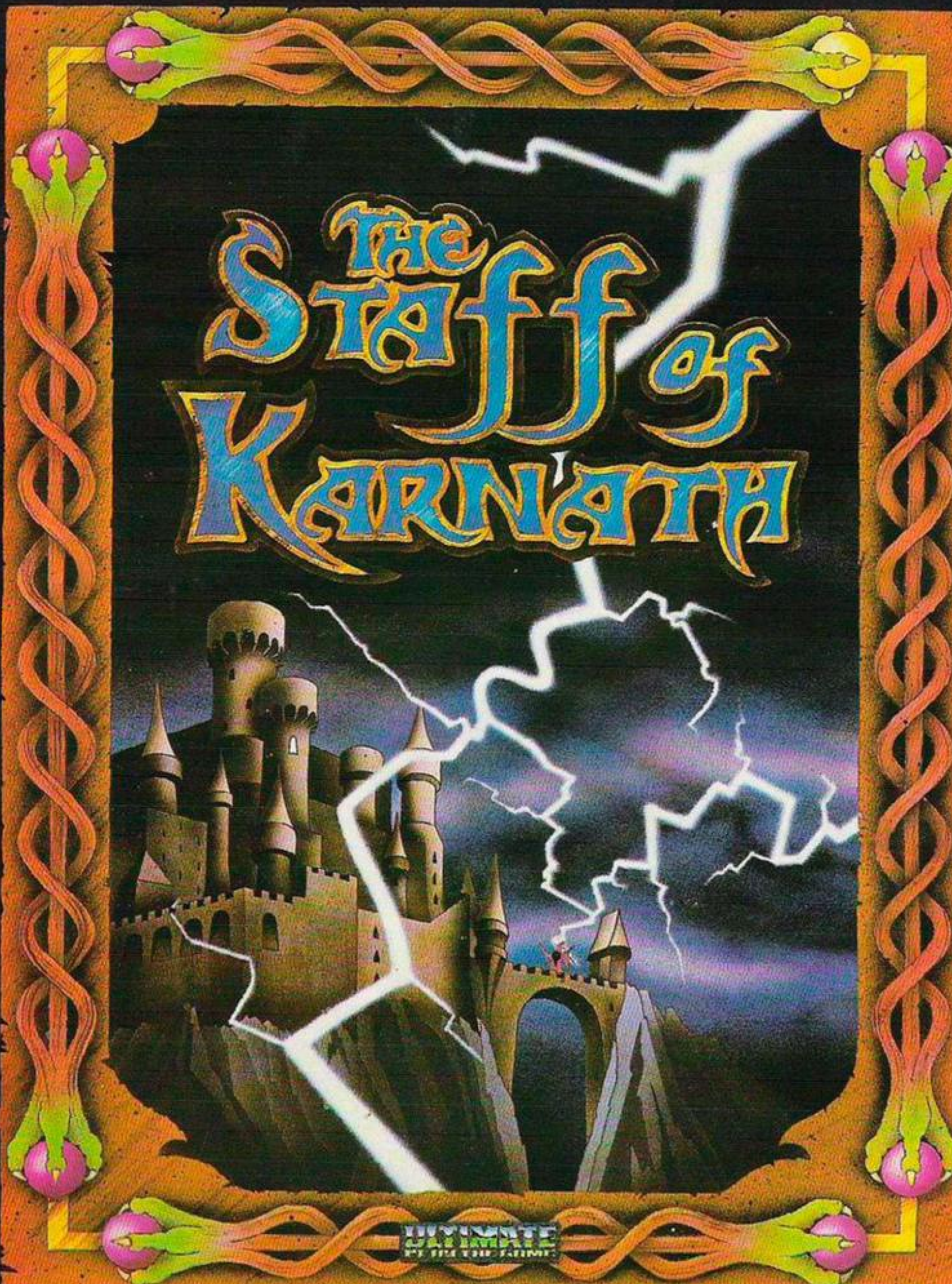

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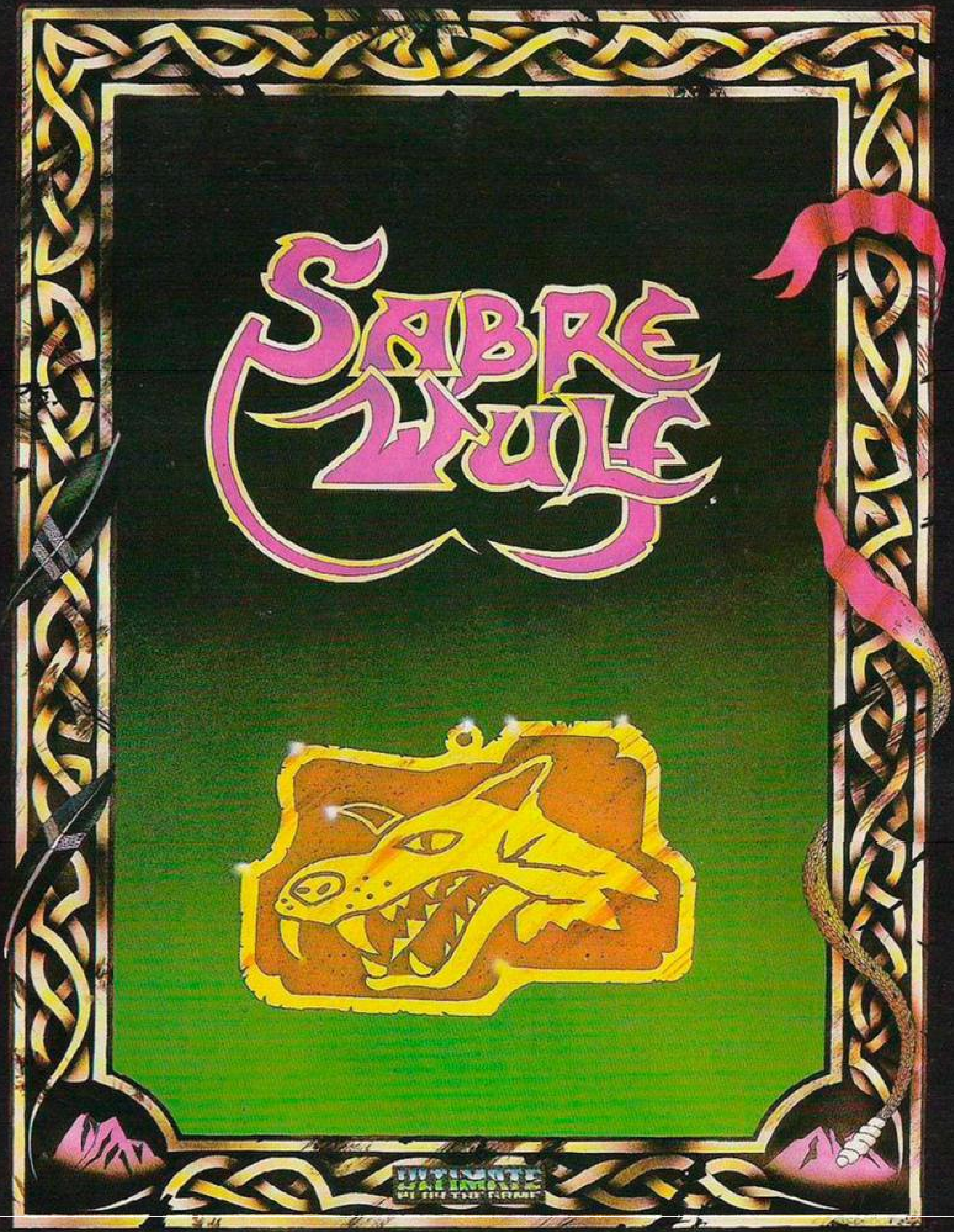

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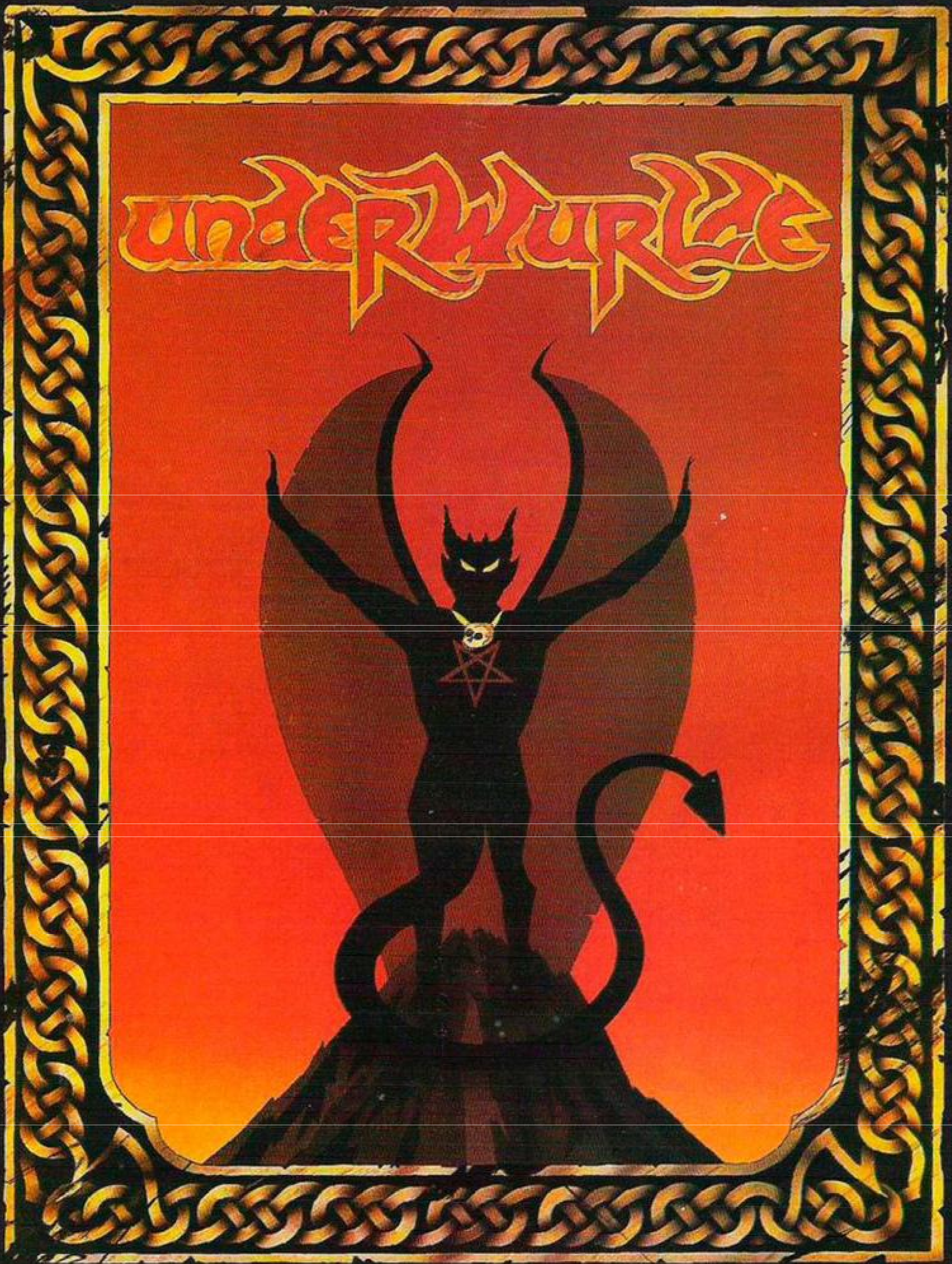

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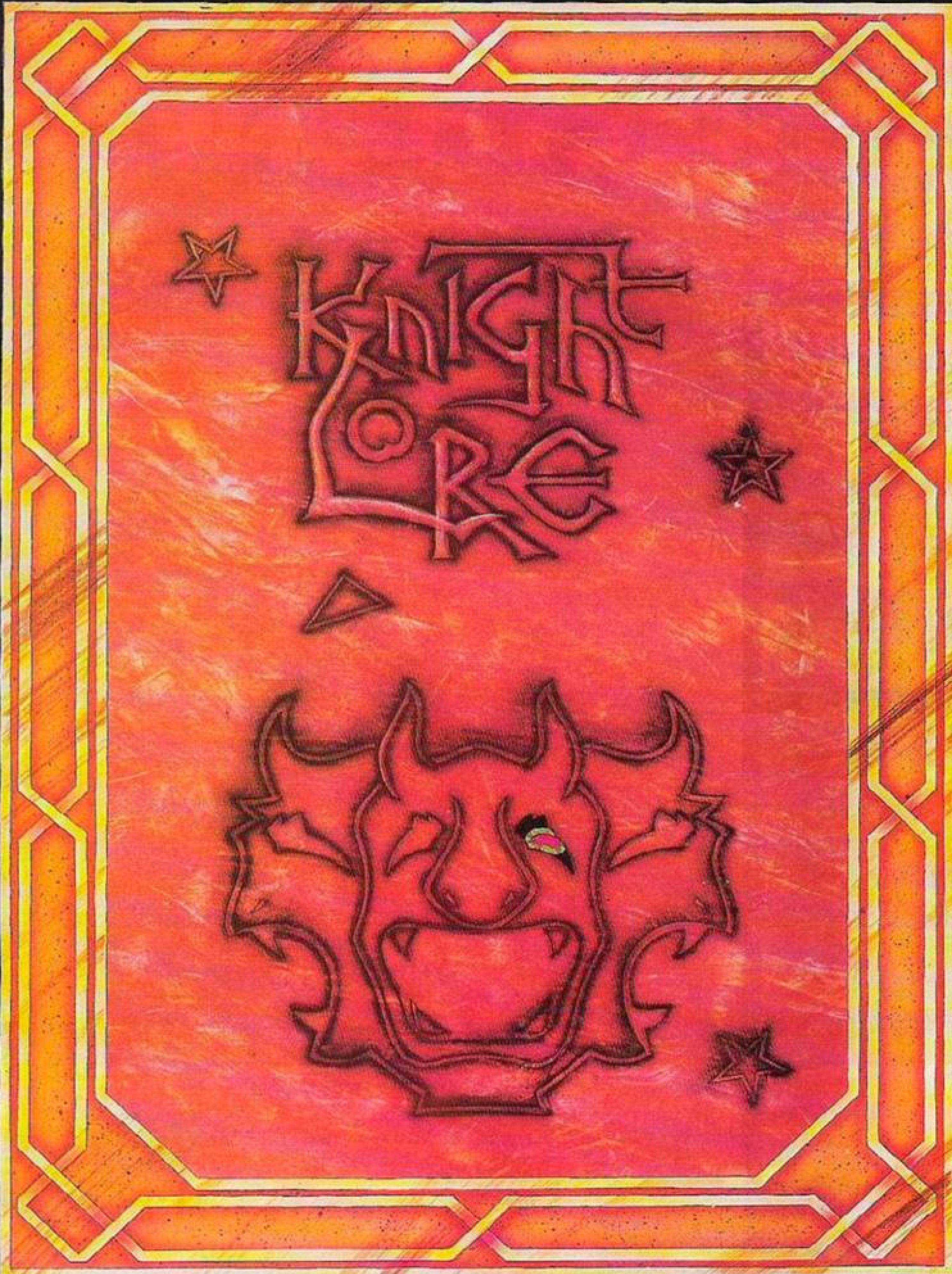

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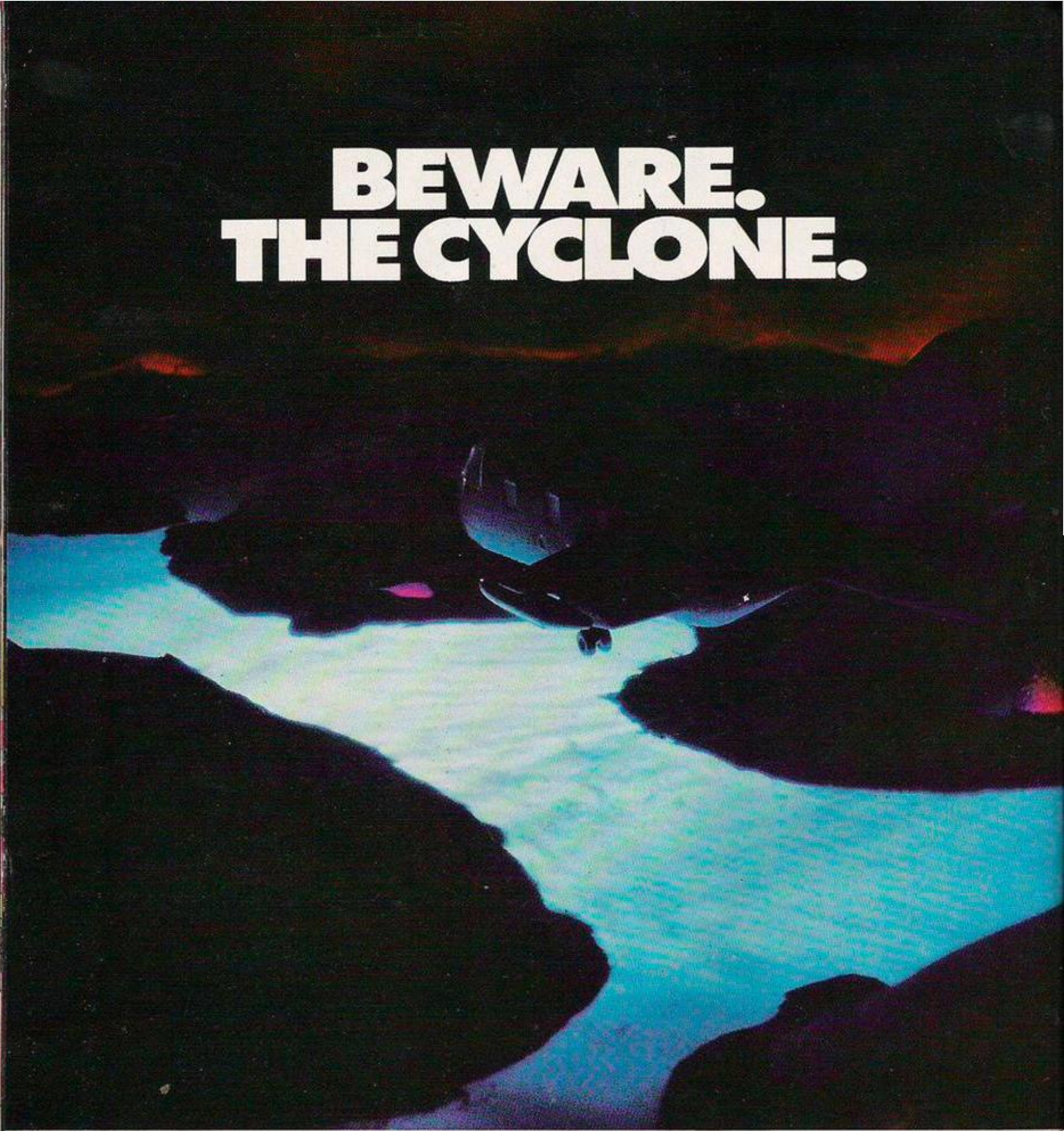

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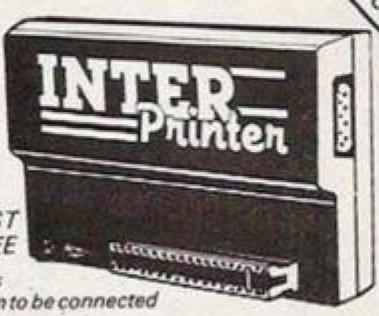

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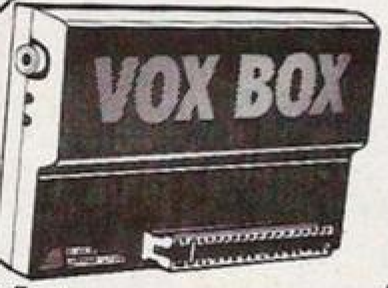

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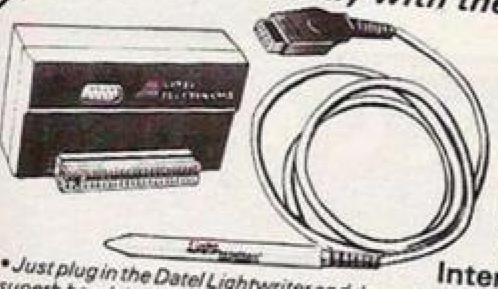

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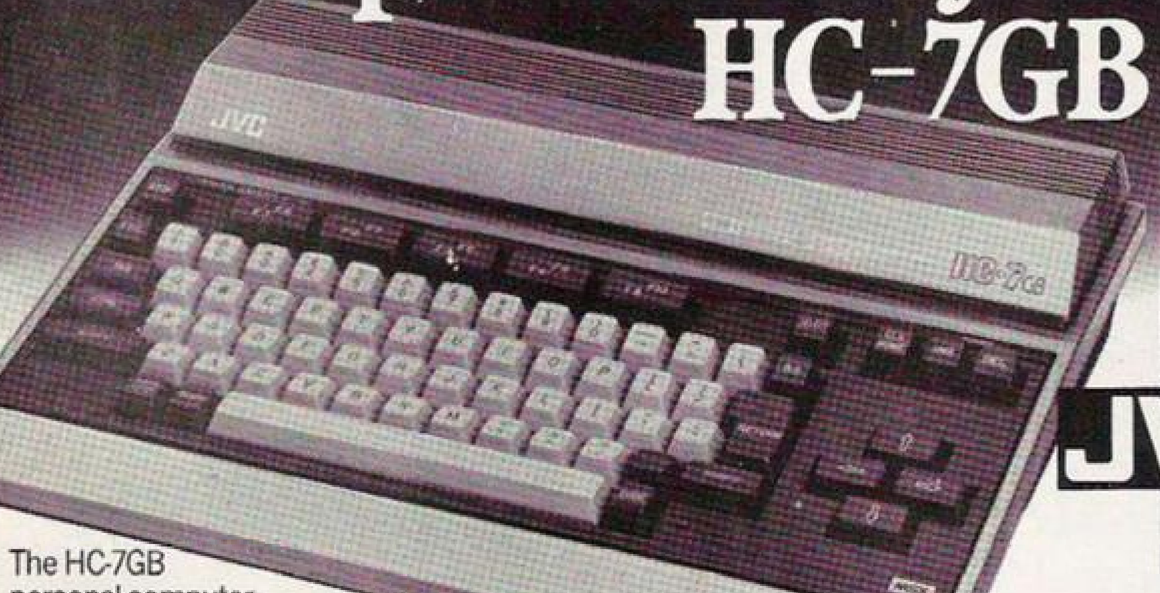

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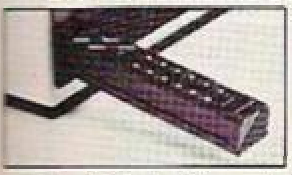

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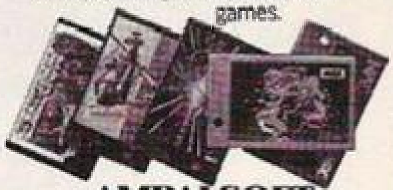

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SPECTRUM + MANUAL MINUSES

I would like to report my experiences with the manual for the Spectrum+, and my first impression that it is a disaster is in no way diminished after thoroughly reading it through.

The manual has no ring binding so that it shuts up like a clam if you want to leave it open on the table while keying in a program from it. Having to use one hand to hold the book open surely defeats the object of having both hands available on the new keyboard.

There is a mysterious back cover which has two folds and opens out to a total width of over 30cm. It's something like the Playboy centre page fold-out except that the girl as well as the clothes are missing! I thought it might be a sort of bookmark where the flap could be folded into a page of text. But this is physically impossible. The fold does not overlap the page width — it underlaps it, falling short by several millimetres. Its purpose completely eludes me. Could someone enlighten me?

The manual of the "ordinary" Spectrum is written in a reasonably straightforward manner. At least I think so. If you wanted to find out about loops, you looked up the chapter on "Looping"; subroutines were dealt with in the chapter entitled "Gosub, Return". In the Spectrum+ manual these topics are covered in "Simple DIY Graphics" and "Designing Patterns and Pictures". And where, might one ask, can you learn about arrays and functions in the new manual? Well, that is not so easy.

Alan Crowe,
Bilthoven,
Netherlands.

JOYSTICK GOLD

As it stands the Commodore 64 Program Bullion, printed in *Your Computer* September will not run. With the following changes all is OK: in line 8 instead of SR= 54292, change the SR to ZR; and in line 1500 change Poke SR,0 to Poke ZR,0.

Also I have included a joystick routine which other readers may like. Also you can still use the keyboard if you prefer. The following changes and Newlines must be entered.

```
  0 Poke 56,140: Gosub 2000
170 Poke 198,0: SYS 35841
505 U=35841
506 Read F: If F = -1 then 511
507 Poke U,F: U=U + 1 : Goto 506
508 Data 173,0,220,74,176,7,162,4,
       134,197,76,0,192,74,176,7,
       162,5,134,197
509 Data 76,0,192,74,176,7,162,12,
       134,197,76,0,192,74,176,4,
       162,20
510 Data 134,197,76,0,192, -1
511 For T = 0 to 3: X = 0
512 Read A: If A= -1 then 530
520 Poke 49152 + T * 256 + x,A:
       X=X+1: Go to 512
990 Data 173,52,3,41,1,240,3,32,0,
       201,173,52,3,41,2,240,3,32,
       0,203,76,1,140, -1
```

I do hope this will be of use to some readers. Thanks for an excellent magazine.

T.J. Hackworth,
Ruddington,
Nottingham.

SQUEEZE TEXT

In my article on text compression, published in September's *Your Computer*, line 910 of listing 3 was mis-typed. It should read:

```
910 PRINT # 1; AT 1,0;
    "Press any key to continue"
```

In addition, when the article was edited, some important details were omitted which could be of both value and interest to many readers. The structure of the 16-bit token is:

```
bit 0      : 1 = a two byte token
bits 1-11  : dictionary item no.
bit 12     : 1 = begin word with
             capital
bit 13     : 1 = follow word by a
             period
bit 14     : 1 = follow word by a
             comma
bit 15     : 1 = follow word by a
             newline
```

It should be noted that the text dictionary corresponding to the example given in figure 1 has the phrase "you@are@in" as its first entry, "a" as its second entry, "dark" as its third entry, etc.

The points used by the compression routine are:

```
31535/31536 — Base address of
              Dictionary
31537/31538 — Base address of
              Tokenised
              Messages
31539/31540 — Next address in
              Dictionary
31541/31542 — Next address in
              Tokenised
              Messages
31543/31544 — Number of
              Dictionary items
31545/31546 — Number of Text
              Messages
31547/31548 — Number of input
              characters
31549       — Number of letters in
              word/phrase being
              analysed.
```

The compression routine requires some work space immediately following the pointers so that the base addresses for the dictionary and tokens should be set, for example, at 32000 and 40000 respectively.

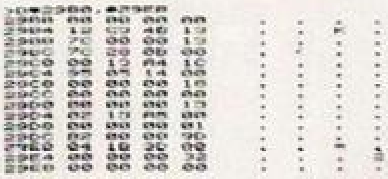
The degree of compression which may be achieved will depend obviously upon the nature of the text database. Typically, savings of 40-50 percent may be obtained using the text compression system described in the article.

A. Tobias,
Thornbury,
Bristol.

TANKS CODE

I'm writing to let you know that there seems to be a piece of code missing from my game *Tanks*. Below is a printout of the missing piece of code.

R. Ludkewicz,
Wildmill,
Bridgend.



LOADING TROUBLE

I was interested to read in *Your Computer*, October in the Response Frame section a letter concerning loading trouble. May I comment further on this?

Considerable loading trouble is obtained from tapes which are "data compressed" — classified under "Fast loading", "Turbo Jet", etc.

The standard tape deck cannot cope with such data compressing. Why try to turn a £200 machine into the equivalent of a £2,000 one? Does it greatly matter that 10 minutes loading should be compressed to two minutes?

Your correspondent will find that he is not unique with such loading problems. Mirrorsoft Ltd. have themselves kindly agreed to resupply a "normal tape" for a "data compressed" tape should trouble arise in loading.

Tim Hartnell gives good advice: "return to dealer and get one that loads!!".

Eve Mills,
Nailsea,
Bristol.

MORE LIVES

Firstly may I say what a brilliant magazine *Your Computer* is, being practically the only one to cater for us machine-code freaks. Taking J. Charlesworth's "Dangerous Gardens" as an example, the quality of the graphics and games play are up to "Ultimate" standard. It even surpasses "Pssst", on which I think it may be based.

But onto the main point of my letter — re the aforementioned program, I can reveal how to get infinite lives! Simply add line 75:

```
POKE 28275,255
```

and you instantly have lots of lives. What disassembler did I use to find that out? Well, actually, I didn't — I simply took a method that I used on my 16K ZX-81 and transposed it into my Spectrum. It only takes up one line and could be used on any micro that uses Basic. The line is:

```
FOR I = START TO FINISH: PRINT
I;"";PEEK I: NEXT I"
```

where Start = the start of the machine code and Finish = the end of the code. If the start of the code isn't known,

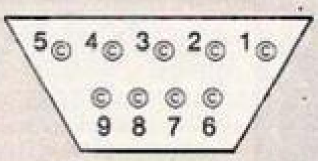


Figure 1.

From QL		to Socket
GRND	BLACK	7 GRND
TXD IN	WHITE	3 RXD OUT
RXD OUT	GREEN	2 TXD IN
DTR IN	BLUE	5 CTS OUT
CTS OUT	RED	4 DTR IN
	ORANGE	OMIT

Figure 2.

USING A ZX PRINTER WITH QL

If you already have a Spectrum with Interface I and a ZX printer and have upgraded to a QL as I have done, but can't justify a "proper" printer yet you may be interested in using your ZX printer for listings. The method I used is very simple and uses the serial 1 port on the QL and the 232 port on the Spectrum.

Firstly, you will need to wire up a 9-way plug — see diagram — to the end of the free printer cable given with the QL. Remove the large plug by carefully unsoldering the six wires. Re-solder the wires to the 9-way plug as shown in figure 2.

Insert one end of the cable into SER1 of the QL and the other into the RS—232 socket on Interface 1. The following program must be entered into the Spectrum and Run. I used baud 600 for no particular reason.

```
10 FORMAT"t";600
20 OPEN#4;"t"
25 LET A$=INKEY$#4
26 IF CODE A$=10 THEN LET A$=CHR$ 13: GOTO 30
27 IF CODE A$<32 THEN GOTO 25
30 LPRINT A$;
40 GOTO 25
```

Load a listing into the QL, and enter the following as direct commands:

```
BAUD 600
OPEN #6,SER1
LIST #6
```

Lo and behold, the ZX printer will spring into life and produce your QL listing!

use the address that follows Rand USR or whatever method your machine uses to run machine-code programs. Then if, say, you wanted to change the amount of lives in a game where you start with three lives, simply write down all the addresses which have the Peek value of 3 and Poke each in turn with your desired amount of lives. Be prepared, however, to reload the program, should your Pokes crash the machine! This could mean a very long time waiting, especially if you own a Commodore 64. Long live Uncle Clive!

Jon Rose,
Bognor Regis.

MIDWAY ERROR

I feel I should correct a mistake in a brief review of Battle for Midway on page 51 of the November issue of *Your Computer*. In the review you state:

"All you have to do is sink the four Jap carriers and they all troop off the map, victory to you!" A gross over simplification of what is a very complex and historically accurate wargame.

The next line of your review says:

"So how come after sinking four carriers, you then get hit by aircraft and lose the game?" There are two ways I can answer this statement:

First, their are five aircraft carriers split between the *three* Japanese fleets. The first fleet has four carriers, the second one carrier and the third fleet, whilst not having any aircraft carriers, has the capability of launching seaplaines. I think that explains how your reviewer may have lost the game.

Secondly, the Japanese bombers have a flying time of 180 minutes. It is therefore quite possible for the planes to be launched and proceeding to attack the US fleets before any U.S. aircraft make an attack on the Japanese carriers.

Indeed, in the final stage of the actual battle, U.S. aircraft were attacking the last Japenese carrier at the same time as Japanese aircraft were attacking the *U.S.S. Yorktown*. By the time the Japanese had returned to where their carrier should have been, it had been sunk. Yet another way inw hich your reviewer could have lost the game.

As a final comment, I would like to say that while I am totally in favour of critical reviewing of products, I am rather disturbed that your reviewer has totally condemned our product in the eyes of your readers simply because he either didn't play the game for long enough or because he didn't take any notice of the information given by the program.

I understand that there are severe time constraints on any magazine article, but a quick telephone call to PSS would have explained to him that the program is *not* "fatally flawed" as he puts it.

Six months of research and design went into Midway

Gary Mays,
Managing Director,
PSS,
Coventry.

AS WINTER SETS IN, Cold War computer games seem to reflect the chill in the political climate. On the same day that President Reagan was re-elected for "The Second American Revolution" — this time based on military muscle — and the Soviet Union was rattling its nuclear sabres around Red Square, the arcade adventure Raid over Moscow was launched.

Typical of the present crop, Raid over Moscow encourages you to take out Minsk, Leningrad and Saratov as the only way to save your hearths and homesteads. Although it was written by Mormon Bruce Carver in Salt Lake City, don't expect any Christian sentiments in this season of peace and goodwill to all men.

Even though the Americans have played ball in the game and dismantled their nuclear arsenal, the communists have reneged on Salt IV and their missiles are speeding towards targets in North America: "The Soviets believe their treachery will lead to total world domination."

U.S. Gold, the U.K. distributor of the game, says that despite the "elements of violence and political overtones" the program is "escapism and not indoctrination" and might just as well have been called "Raid over Birkenhead" for all the offence it should cause.

But before you conclude that all violence and aggression in computer games originates in the West, it's worth noting that a Yugoslavian team of programmers recently came up with an amusing little number which, roughly translated, goes by the name of Sink The Nato Fleet. Perhaps if the Eastern Bloc home computer market were not so limited we would see more of the Warsaw Pact's equivalents of Raid over Moscow.

Few of these overtly war-mongering computer games have been produced in the U.K., although in mid-1982 Bomb Buenos Aires was released by a British software house to cash in on the Falklands conflict.

Taken at its most extreme, the lobby against violence in games would argue that even zapping aliens is wrong. Christian Penfold of Automata — the software house that champions non-destructive computer games — believes that any form of on-screen killing makes people more insensitive to violence in real life and more likely to commit it.

That is a difficult argument to prove and not even he would put shoot-'em-ups on a par with video nasties like *Driller Killer* even though the effects of such games may be more insidious.

The middle ground in the controversy puts games like Raid over Moscow and F-15 Strike Eagle, where you have a choice of targets in Libya, Syria and Vietnam, into the overtly propagandist category. But despite their equally violent underlying mesage, programs with a historical perspective — like the World War II Eastern Front for the Atari — are more acceptable.

Until some sort of standards are set you will have to pick your way between Automata's ultra-pacifist line — "Killing is wrong, even pretend killing on little screens" as it says in their game Deus Ex Machina — and Cold War jingoism.

So much for the Christmas spirit — Good King Wenceslas would be a legitimate target, after all he was Czechoslovakian — the only thing that looks like being deep and crisp and even on your yuletide screens is the fallout from a nuclear winter.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Subscriptions: U.K. £12.50 for 12 issues.
Printed in Great Britain for the proprietors Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG. ISSN 0263-0885. Printed by Riverside Press Ltd, Whitstable, Kent, and typeset by Instep Ltd, London EC1.

ABC
154,334
January-June, 1984.

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A supersonic dogfight

F-15 STRIKE Eagle is the home-grown all-American flight simulator which may be involved in a bit of a dogfight sales-wise with Digital Integration's Fighter Pilot. Both simulators are based on the F-15 air superiority fighter; both have now been implemented for the Commodore 64.

Strike Eagle from US Gold was originally implemented on the Apple II and is available for the Atari, too.

Opponents, according to the manual, include the Mikoyan/Gurevich Mig-21, Mig-23, and Sukhoi Su-22, though in fact they all tend to look rather like flying triangles.

This particular graphic gripe apart, the rest of the game has great complexity and depth. You can select forward and rear views à la Star Raiders by pressing the space bar, and the head-up display shows your airspeed, altitude, and line of flight. It also gives you two reticles (American for cross-hairs) one for aiming guns and missiles, another for aiming bombs. There are two target designator boxes, one for aircraft which are too far away for you to see, and one for indicating the position of air or ground launched missiles. You can also release decoy flares.

Your Computer prize-winners save maiden from fate worse than death

SEVEN *"YOUR COMPUTER"* prize-winners diced with death as they fought their way round Treasure Trap Castle. The prize-winners from our March competition were treated to the dubious delights of a real life adventure at Peckforton Castle in Cheshire. Their adventures followed the plot of Castle of Terror, a Dracula type graphics adventure set in the 1800's soon to be released by Melbourne House.

The Castle is rented out by the local landowner to Treasure Trap who use it to stage fantasy adventures in its buildings and grounds. These adventures are based around the rules and ideas in the game Dungeons and Dragons (TM), but instead of moving small plastic models around a cardboard map, participants try to fight their way round rooms and corridors of the castle, often in the pitch dark, opposed by large 'Orcs' wielding bottles of red dye. People come back time and time again. One seasoned campaigner we came across said that on a good weekend he could expect to get killed half a dozen times at least.

Certainly our prize winners

Two of our prize-winners, Alan Berg and Steven Rhodes, have a slight difference of opinion with a couple of Orcs.

enjoyed themselves, and give or take a reincarnation or two, they all came out in one piece, with Dracula suitably disposed of and the fair maiden rescued, although what the laundry service will say about the state of their clothes is another matter.

"We are not amused"

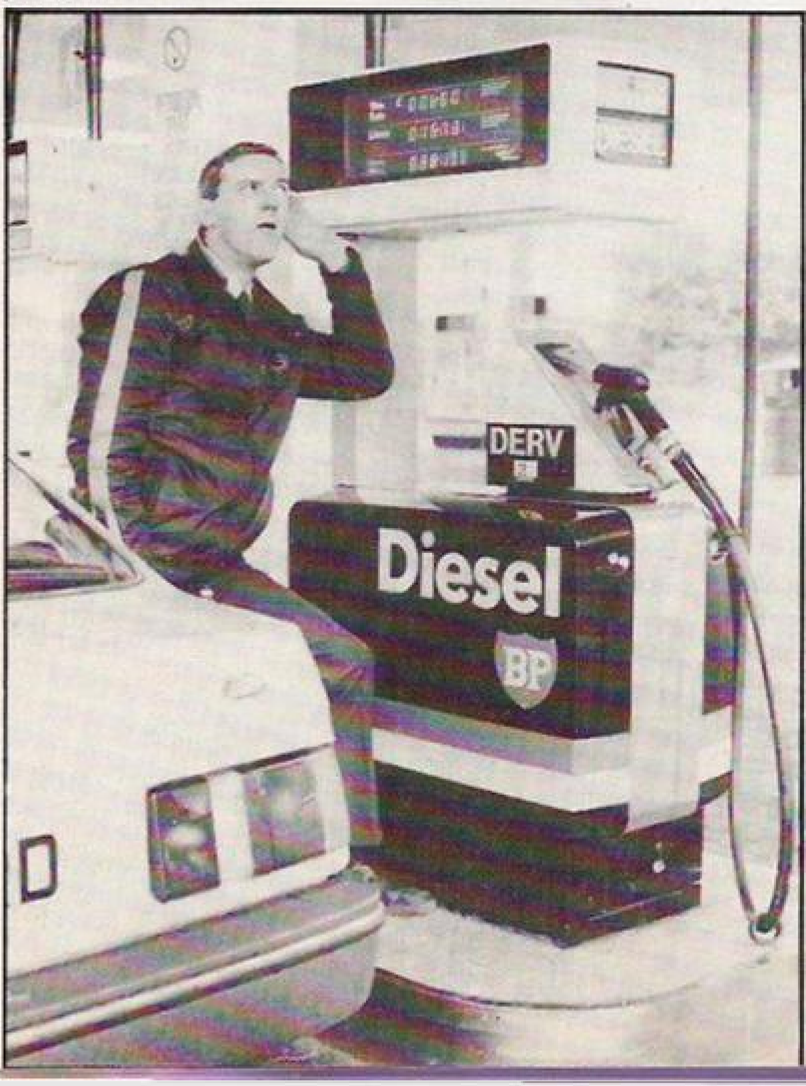
SATURATION POLICING and improved surveillance since a certain Mr Fagan supped a bottle of wine in the Queen's bedroom have at least reduced the number of German tourists camping in the grounds of Buckingham Palace but they have done nothing to deter electronic burglars from breaking into Prince Philip's British Telecom postbox.

It's been a bad couple of weeks for the royals at the hands of computer enthusiasts and not just Prince Philip. A German magazine had offered a £500 bribe to a British hacker to break into computers holding details of Princess Diana's credit card payments — loyally they had refused.

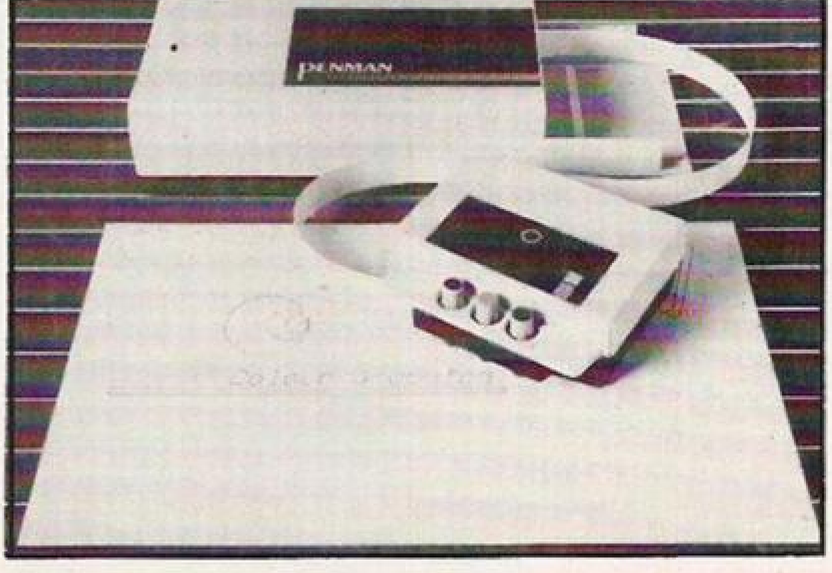
Hal joins the Elite

HAL BERTRAM has become the first to reach "Elite" status in the Acornsoft game of the same name. On Saturday, 3rd November, at 11.39 with as much due pomp and ceremony as you get from the BBC's sound system, he was admitted into the hallowed fellowship of the great immortals of computer gaming.

"Typical Ford Sierra driver — listen cloth ears this is a diesel pump". Gilbarco's new petrol pump uses a Texas Instruments speech chip to remind bleary-eyed motorists that they have gone to the diesel pump — perhaps by mistake. Every year thousands of petrol engines are ruined as dull brained drivers fill up petrol engines with diesel. BP already paints diesel pumps black and petrol white to differentiate them but now hopes that the new Gilbarco pumps will get rid of the problem.



What do you get if you cross a turtle with a plotter? The Penman robot plotter seems to be the answer. It can make three colour posters — chugging around on the paper leaving a trail behind it, or behave like a traditional turtle. Penman comes with BBC software for £250 but will interface to any micro with an RS-232 port.



Schools are to condense the history of the country — part two — onto a pair of videodiscs

THE DOMESDAY Project may sound like the next American arms program but is in fact a latterday version of William the Conqueror's Domesday Book. BBC Enterprises have launched the £2½ million project with the idea of compiling a comprehensive survey of modern Britain.

But instead of storing the information on paper it will be held on videodiscs. The system will use a videodisc player driven by a BBC micro.

When the Domesday Disc package is completed in September 1986 — the 900th anniversary of the original Domesday Book — the amount of information it stores will be equivalent to two full sets of the Encyclopaedia Britannica: two million pages of text, figures, and maps, plus 85,000 photographs.

All this will be held on just two videodiscs. The first disc will provide local information. Sitting at your BBC micro you will be able to call up a map of Britain, pinpoint an area with the cursor and then zoom in to a large scale Ordinance Survey map of the area. From there you could read 20 pages of information on the locality, or convert the data into coloured overlays on the map — showing green belt areas, voting patterns, and so on.

The second disc will contain national data — everything from population statistics to details of flora and fauna.

To collect some of the information the BBC is hoping to enlist the aid of 10,000 schools, whose pupils will compile portraits of their areas. Other sources are to include databanks such as the National Data Archive.

The keyword in this project is "interactive". By interacting with the videodisc player the BBC micro will allow you to call up pictures and text on any particular topic. It will also load in programs to manipulate the data and overlay the pictures with high res graphics.

Acorn are writing the software for the system, while Philips are developing a new type of Laservision player capable of storing both digital data and pictures. The whole package which includes the videodisc unit, the discs, and an operating system for the BBC micro, will cost around £1100.

YC goes down the line

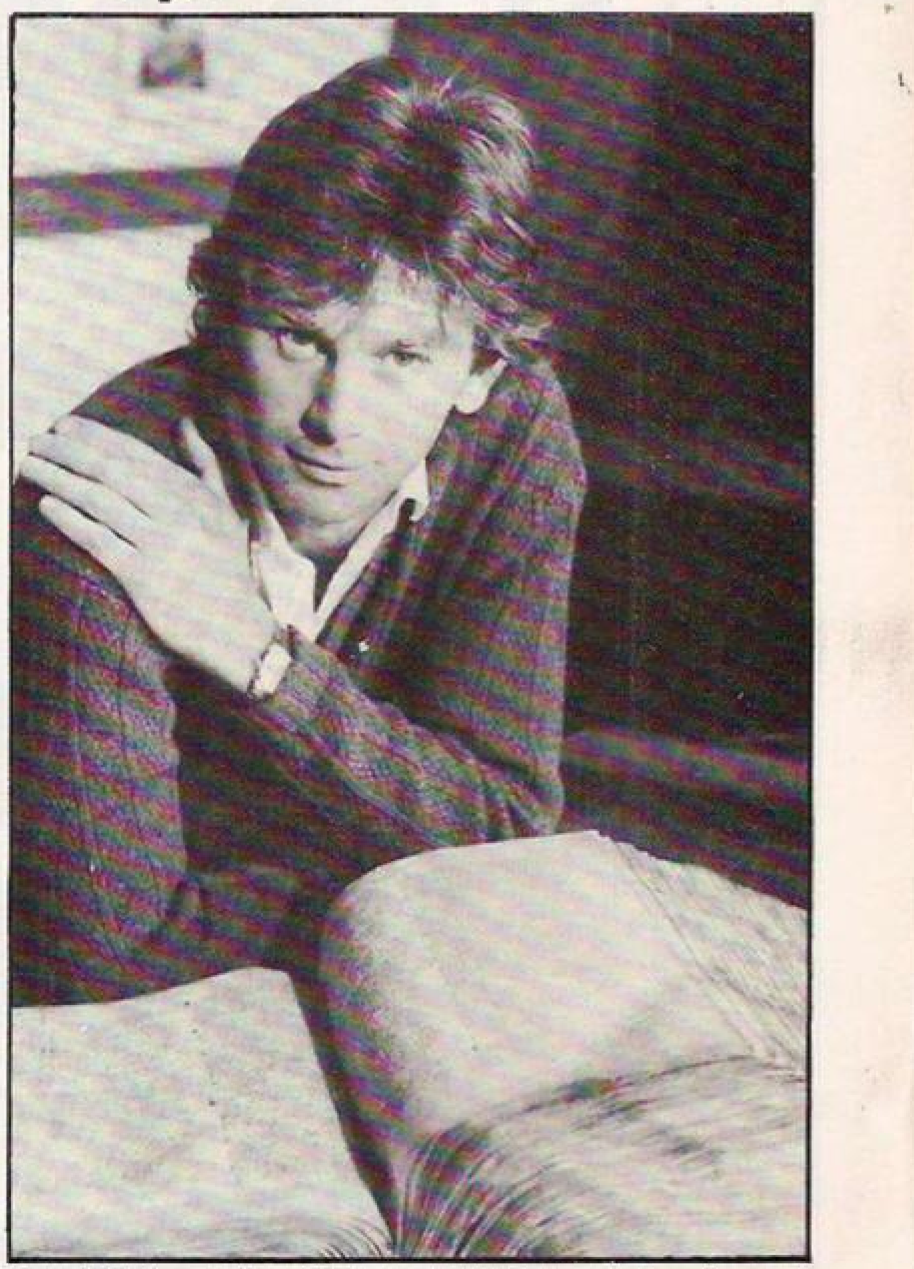
NOW YOU CAN dial *Your Computer* any time day or night and with the help of your modem leave us an instant message. Just ring (01) 661 8978 and wait for the tone after our modem answers the phone. Connect your modem then transmit the address code YRC — making sure you use capital letters only. The acceptance code +++STF GO signifies that all is well, then you can transmit your text using upper and lower case letters, For the attention of ..., From..., Phone No..., Address..., and your message. When you have finished the end of message code is NNNN — in capitals only. Our modem is V21 specification with 300 Baud speed, even parity and 10 bits per character.

Frontrunner — wait for it

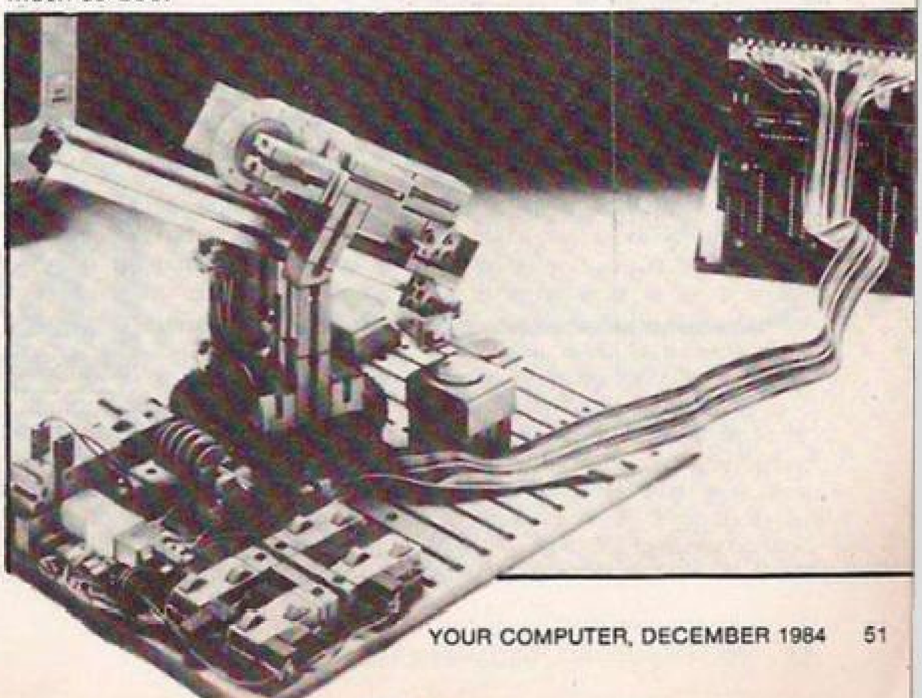
IN THE NOVERMBER issue of *Your Computer* we mistakenly ran an advert for Frontrunner's new game Dead City rescue. We are told by Frontrunner that the game will not be ready until the New Year.

YOUR COMPUTER TOP 20

Title	Publisher	Machine
Avalon	Hewson	Spectrum
Beachhead	US Gold	Spectrum
Braxx Bluff	Micromega	Spectrum
Chiller	Mastertronic	CBM 64
Combat Lynx	Durell	Spectrum
Daley Thompson Decathlon	Ocean	Spectrum
Danger Mouse in Trouble	Creative Sparks	Spectrum
Delta Wing	Creative Sparks	Spectrum
Elite	Acornsoft	BBC
Frak	Aardvark	BBC
Jet Pac	Ultimate	BBC
Jet Set Willy	Software Projects	CBM 64
Kokotini Wilf	Elite	Spectrum
P.C. Fuzz	Mr Micro	Vic 20
Sherlock	Melbourne House	CBM 64
Solo Flight	Centresoft	Atari
Spitfire Ace	US Gold	CBM 64
Summer Games	Quicksilver	CBM 64
Tornado Low Level	Vortex	Spectrum
Zaxxon	US Gold	CBM 64



From BBC Buggy builders Fischertechnik this new robot arm is one of six models which can be built using a £65 robitics kit. The kit includes motors, potentiometers, micro switches, and an electro magnet as well as a Meccano-style construction kit. With these you can build an assortment of robot arms and even a tracking mechanism which could be used to follow a star across the night sky. The arms can be operated by a Spectrum, BBC or Commodore 64 — the only snag is that the interfaces can cost as much as £50.



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I could do that...

October's competition asked you to write a program which would rotate a square about any centre. So long as you knew the necessary transformation matrices this was a fairly simple task, and most of the programs submitted adopted the same approach.

We awarded the £15 prize to David Murphy, Bolhalel House, Llangunnor, Carmarthen, Dyfed. We judged his program the shortest and simplest. Admittedly it takes advantage of BBC Basic's superior power and economy.

Line 250, in particular, would be difficult to convert to other Basics. It draws a line in the logical inverse colour of the old pixel colour. In other words it either draws a square or blanks it out. This allows the program to erase squares after they have been rotated.

If you would prefer to keep all the squares on the screen replace Gosub 230 in line 130 with Rem.

The other important lines are 150 and 160 which calculate the new coordinates.

For this month's competition we are setting you another exercise in artificial intelligence. Write a program to play noughts and crosses on a 3 by 3 grid. The shorter the listing the better.

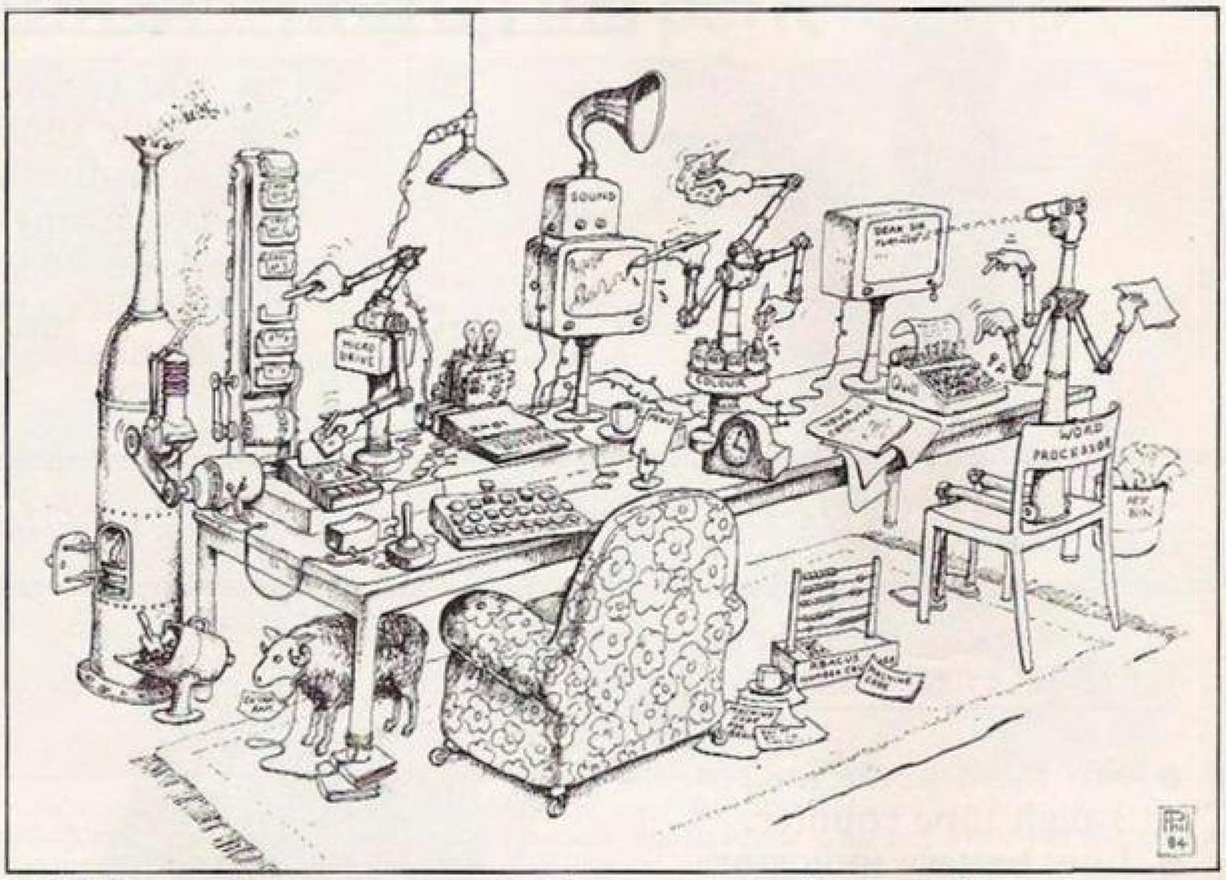
You could include a routine to handle the computer's playing strategy but it would be more interesting to make the program learn from experience.

After 10 or so games it should be able to draw every time.

```
10 MODE 4
20 DIM X(4),Y(4)
30 FOR L=1 TO 4
40 READ X(L),Y(L)
50 NEXT L
60 GOSUB 230
80 INPUT "Enter X coord of centre "XC
90 INPUT "Enter Y coord of centre "YC
100 INPUT "Enter size of step in degrees "A
110 SA=SIN(RAD(A)):CA=COS(RAD(A))
130 GOSUB 230
140 FOR L=1 TO 4
150 X=(X(L)-XC)*CA-(Y(L)-YC)*SA+XC
160 Y=(X(L)-XC)*SA+(Y(L)-YC)*CA+YC
170 X(L)=X:Y(L)=Y
180 NEXT L
190 GOSUB 230
200 A=GET
210 GOTO 130
230 MOVE X(4),Y(4)
240 FOR L=1 TO 4
250 PLOT 6,X(L),Y(L)
260 NEXT L
270 RETURN
280 DATA 340,812,940,812
290 DATA 940,212,340,212
```

BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.



Word-processing makes it easy

MENTION WORD-PROCESSING and most people think of huge £3,000 dedicated machines which require trained operators. Above all you think of work: typing, letters, memos — hardly what home micros are all about. But things are changing.

Word-processing programs have been around for some time for most machines — though on some, like the Spectrum, they have been pretty much of a joke because of the poor keyboards. Now, however, manufacturers are not only beginning to produce machines that are suitable for word-processing, but they are even throwing in a program with the machine. Both the QL and Commodore's Plus 4 have good keyboards and bundled word-processing packages. It can only be a matter of time before some of the MSX machines and others do likewise.

Once you have coded each letter as a number — using ASCII, or American Standard Code for Information Interchange — then a computer will happily manipulate them like strings of digits. In fact micros are so good at pushing words around the only problem is that you will never want to use anything else.

You don't even have to be able to type to use a word-processor. You can make as many mistakes as you like, change your mind as often as you like, and need never have to worry about layout and presentation. The only limitation in terms of output is the quality of the paper and printer you use.

Apart from this obvious basic ability to change things, perhaps the main feature of word-processing is wordwrap. This simply means that at the end of the screen you do not have to type carriage return. The micro will notice that you have exceeded the specified width and take over the current word to the next line. It will also only take over whole words: ordinary screen handling routines in Basic break words anyhow when you go off the screen.

Related to this is justification. When you type on an ordinary typewriter, the left-hand margin is nicely lined up, but the right-hand one is all over the place. Justification is the process of spreading things out — usually by inserting spaces between words — so that both sides line up, as in this column.

You should also be able to centre text. This means that a group of words will be placed neatly in the middle of a line with equal space either side. All of these features help you make the layout more attractive, as do facilities like underlining, boldface and italic scripts.

Word-processing also allows you to make radical structural alterations. It often happens that when you get to the end of some carefully typed letter, you realise you should have put that last paragraph in at the top. Not only does a word-processing program let you do that, it will even save you the effort of re-typing it all. The process is called a block move.

First you define the words to be moved. This might be a paragraph or group of sentences. Next you mark the point where the block is to be moved to. You then have two options.

(continued on page 55)

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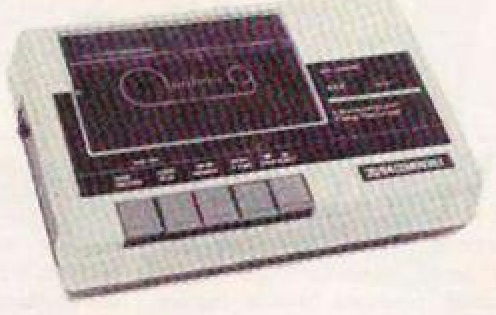

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(continued from page 53)
Either you can make a copy of that block, leaving the original block intact, or you can move it entirely.

A facility drawing on the computer's ability to perform mindlessly repetitive tasks quickly is search and replace. Looking through a long text for a particular name or word is a tedious process, but a micro just laps it up. Once it has been found, most word-processing software offers you the option of going on to the next occurence or replacing the one just found. Some programs even let you specify the word and its replacement, which is then carried out throughout the document. This could be useful when you have consistently mis-spelt someone's name.

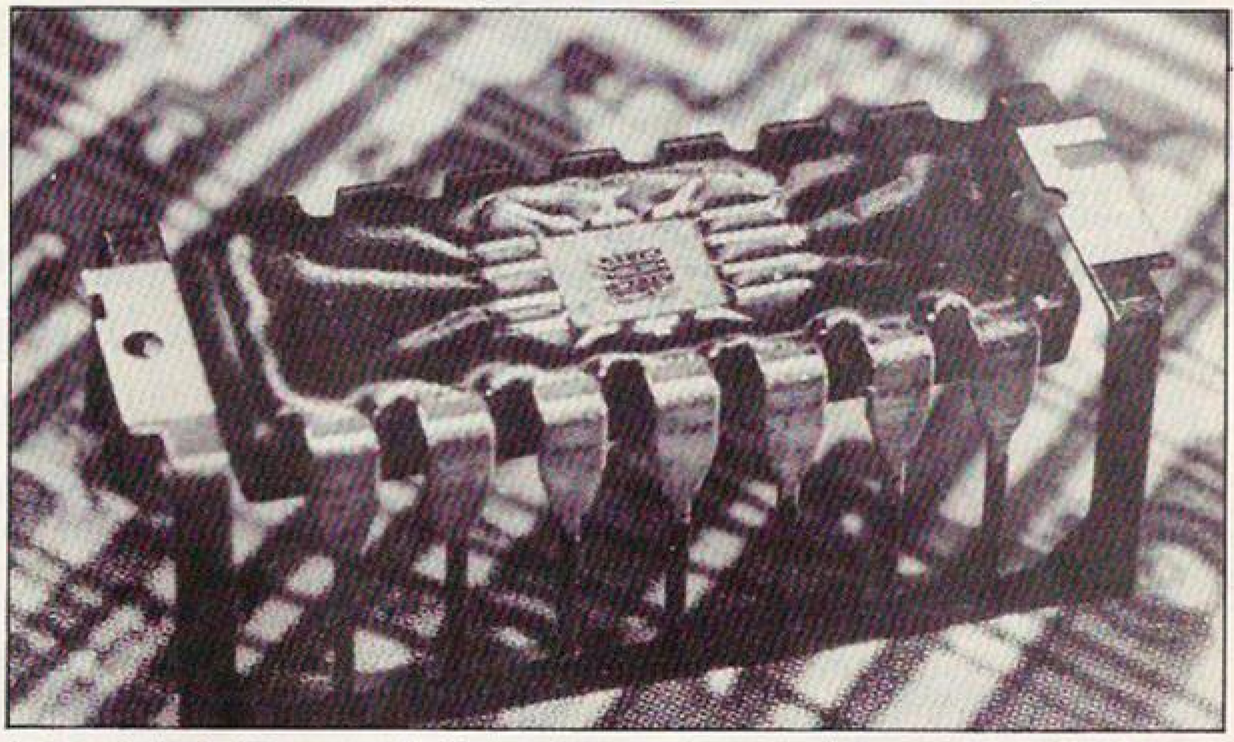
The specific way that a program does these things, and shows them on screen, varies widely. Some use complicated strings of commands that you have to memorise, others use function keys, and others the first letters of words like Search and Block. Some programs cannot show bold or centred text on the screen, though they can produce it on the printer. The best type of word-processors are called WYSIWYG. What You See Is What You Get. The screens show exactly what will come out on the printer.

Often, though, your text will contain all sorts of hieroglyphics which mark where blocks begin or italics end. One advanced feature that is certain to require this is mailmerge.

Mailmerge is a very powerful facility that lets you set up standard letters — say a Christmas thank you note — but with gaps left for the name, address and wonderful present that you had always wanted. In the gaps you place special codes that refer to another file that contains the missing information. At the time of printing you instruct the computer to fill in the missing details from the other file you have set up.

BEGINNERS first bytes

The fine art of frying up the perfect chip



EVERYBODY KNOWS that at the heart of the micro are its silicon chips. After all, there have been enough bad jokes about chips with everything, chip off the old block and chipshops. But as people blast a few more thousand aliens into kingdom come, they tend to take its amazing technology for granted.

Externally, chips look pretty unexciting. Along both sides of a dark rectangular epoxy case, about 40 metal pins emerge. These are simply the connections to the tiny sliver of silicon inside. This is about 5mm square and 1mm thick. Yet within this small area there may be crammed something like 50,000 components.

The idea is simple. Imagine a computer built up out of standard components like the transistors you might find in a cheap radio. This is in fact precisely how computers were built in prehistoric times — that is about 25 years ago — which is why big mainframes filled rooms. Most of the bulk is taken up by casings and wiring. In fact transistors don't need to be big at all: they are used just as switches, either on or off, to represent the binary 1s and 0s used by computers.

So reduce them to mere specks of silicon, without casings. Then pop it into an oven, and let it melt — in a controlled way. You then have a small slice of silicon that has all the components built into it. This is a chip.

Of course, the techniques used to produce modern-day chips are rather different, but they do draw on the same idea of one lump of silicon with lots of microscopic components.

The transistors used in radios and chips are essentially sandwiches of different flavours of silicon. A chip is built up by starting with the bottom slice of silicon, and adding successive layers of silicon, which are "doped" with tiny quantities of other elements to give the different flavours. Special techniques are used to melt these different layers together.

The individual transistors are created from this "chip sandwich" by etching away some or all of these layers. A transistor is like a tiny island of exotic silicon rising out of the bottom layer. Microscopic conducting bridges can be built between these islands to link the transistors together in electronic circuits. The way you connect them determines what type of chip you have. The basic technology is the same for them all.

Chips have become more and more powerful as ways of making these islands smaller and smaller have been devised. The other design problem is working out how to fit them all onto the chip, and in particular in such a way that connections do not cross.

To do this with 50,000 components requires a powerful computer and advanced graphics programs. At the end of the day, the chip design is effectively drawn on a huge piece of paper. This is then photographically reduced to the size of the chip. By projecting it onto a photographic film placed on the surface of the silicon sandwich, it is possible to map out the islands that become the transistors.

There are two main categories of chips: processors and memories. The processor is the workhorse of the micro. It does all the calculating and generally keeps things running. It will normally have a main adding device and various storage areas. These will hold data briefly before it is manipulated, and also note things like whether the result of calculation is zero or negative. A record is also kept of where the next instruction or data is to come from.

Memory chips are simply huge arrays of transistor devices, each of which can be addressed individually, and which can store a 0 or 1. Thus chips that have a memory capacity of 16K have over 16,000 separate devices that can be individually selected, and then read or altered. Clearly, the internal wiring problems of keeping all the lines for finding and accessing particular locations tidy on the chip are horrendous.

Another problem with Ram and processor chips is heat. All the time that a chip is running it is drawing electrical power. Flipping a 0 into a 1 or vice versa uses energy that eventually appears as heat. This has actually been a constraint on chip size. It is theoretically possible to build extremely small chips that would actually melt themselves as soon as you used them.

So, gradually new technologies in chip design have been evolved to overcome this. These have yet to filter down to the low end of the home micro market, but it is not far off. For example, Apple's new incarnation of the Apple II, the IIc, uses this technology, as do the small lap portable computers.

Rom chips do not suffer from this problem so much. Since these read-only memory devices cannot be changed there is no need to keep on pumping electricity through them to keep them active.

There is one variety of Rom which is unfortunately becoming more common in new micros. This is the PRom or programmable read-only memory. They are Roms that do not come with the program already built into them using the same silicon island techniques for Rams and processors, but are supplied as clean slates. You can then reset some of the devices to the values you want. This is much quicker than designing a whole new chip. Which is why manufacturers who are in a hurry to get a machine out use them — e.g., the Sinclair QL.

Finally, there is a type of general purpose chip, called the ULA — the uncommitted logic array. Like the PRom, this allows a micro manufacturer a certain freedom to reprogram it for its own needs. Unlike the PRom, though, it represents an acceptable way of saving money and board space. They also point the way of the future. Some of the most advanced chips now coming though are complex multi-purpose devices that not only have processors but memory on board too — in other words almost a complete computer. These really will be chips with everything.

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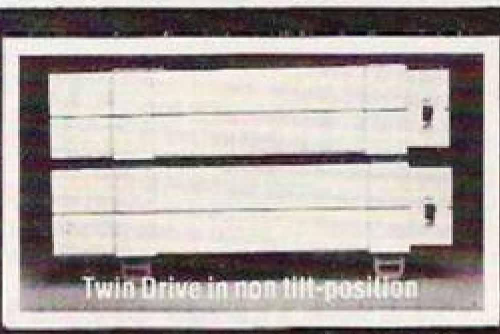
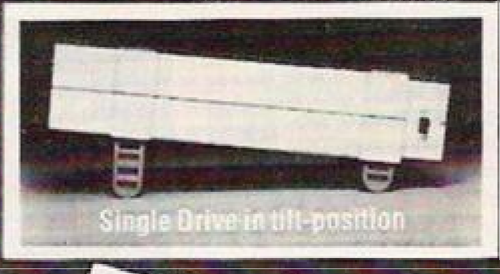


Twin Drive in non tilt-position



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Local news

Penwith

Penwith area Independent Computer Club meet at St. Paul's Old School, Taroveor Road, Penzance. Contact Jeremy Hewitt, Club Secretary on Penzance 787159. Holds meetings and rallies where local software and hardware distributors display their wares.

Gloucester

A Spectrum user group meets weekly on Wednesday or Thursday. Contact Barry Ledbury on 0452 23186.

ZX Exchange

ZX-81 owner? Feeling lonely with all these flash Spectrum owners kicking bytes in your face? You need ZX Exchange, the only remaining international postal forum exclusively for the ZX-81. Provides a bi-monthly newsletter, software, tips and listings. Contact Nick Goodwin on 0390 50965.

Waterford

Waterford, Eire, is the home town of OIFIGiuil, which is Irish for the Official Irish Forth Interest Group. Recognised by FIG(USA) potential membership is widespread — Dublin, Mayo, Cork. More details are available from Hugh Dobbs, Newton School, Waterford, Eire.

Stoke

Mixed Bytes Computer Club meets at Dilhorne New Road Recreation Centre, near Stoke-on-Trent on every other Thursday from 7.30 to 9.30. Contact Alan Cope on 0782 396003.

COMPUTER club

Lee Paddon visits the Medway Computer Club and can't find a Pac-Man or Space Invader in sight — but he does discover The Last One!

WALDERSLADE SOUNDS as though it would be more at home in The Archers than in the middle of Kent. Despite this, your intrepid reporter followed his instructions and soon found himself in a burgeoning new village near Chatham. Nestling somewhere between Whimpyville and Barratt Platz, I came to the Walderslade Centre, home of the Medway Computer Club.

The club holds its meetings in the offices of B&D Microtronics Ltd., a computer retailer which is run by one of the club members, Paul Cameron. Instead of the usual cacophony of aliens being rent assunder and Pacmen getting indigestion, there was a deathly hush broken only by a voice saying, "Append, Execute" into a microphone attached to a micro.

I was reassured by Paul that this member hadn't finally gone off his rocker after having been exposed to too many disc crashes, he was in fact getting the new Apricot used to his dulcet tones so that it would obey his merest whim without question.

The new Apricot F1 was one of the latest in Paul's stock line and the members seemed to appreciate this brush with the latest technology even if it was a bit outside their price range.

The club itself owned no hardware but they hope that their limited resources might stretch to setting up a club library this year. This lack of hardware was more than made up for by the members who favoured Sharps, BBC's and Apricots to the more pedestrian machines found at other clubs.

Apparently a Spectrum owner had turned up last year but had clearly felt his machine wasn't up to the competition. This preponderance of up-market machines wasn't due to any snobishness, but due to most members using their micros professionally.

A modem project has been very popular with club members over the past year. No longer content with talking amongst themselves, they have decided to convert the modems to the V21 standard. This will allow them access to a whole range of databases, including *Your Computer's* very own Telsoft. So a few evenings messing around with oscilloscopes lies ahead.

The club has regular lectures by its members on various aspects of computing. Lectures about various languages and software such as Lotus 1-2-3 are planned.

Les Mason, club secretary and treasurer expressed his opinion about The Last One, which he had been trying out on his Apricot. The Last One is supposed to be a program writer. You follow a menu-driven process of selecting routines to execute the flowchart you have written. "It takes so long to run, and there are only so many cups of coffee you want to go and make during an evening. And even when it has finished you still end up with syntax errors in the compiled code." Perhaps it should be renamed "At Last, one that works". Les was thinking of following the example of another club member who had successfully taken Apricot to court over the program.

So if you are seriously into computers or feel your mission in life is to show these misguided people that games are really great fun, then you should get in touch with Paul Cameron on 0634 63036. The club meets once a week, alternately on Tuesdays and Wednesdays.

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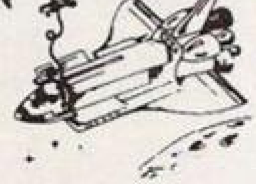

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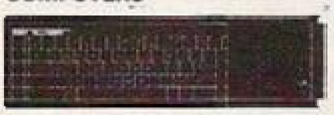

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SOFTWARE Shortlist

Star★chart

Fireflash
Oric 1/Atmos
No man's land
Shoot-'em-up
★ ★

A promising hi-res black-and-white from this French company. At the top of the screen, le radar représente les vaisseaux hostiles, and you manoeuvre around à la Defender to shoot the UFOs down. Keys are a little tricky on the Atmos, but would be fine on the Oric 1. Stirring electronic fanfare and competent sound effects. Don't see much Oric stuff from UK companies these days, so looks like the French will cash in on a neglected user base.

Star Avenger
Amstrad CPC-464
£8.95
Kuma
Shoot-'em-up
★ ★ ★

A really good Defender-inspired game for the Amstrad, worth comparing at least for ingenuity, with English Software's Airstrike II for the Atari. You have 10 scenarios to choose from: planet, cavern, tunnel, fireballs, bats, aeroplanes, city, maze, fortress and forcefields.

The maze is a really tortuous chequerboard affair which will certainly require you to use your retros as much as anything else — this is the only way the really mean right-angle turns can be negotiated. The aeroplanes are good, too; kamikaze-like, they speed up as they approach you in a last-ditch attempt to terminate your mission.

Osprey
BBC B
£6.50
BES
Ecological
★ ★

This program educates people about the plight of ospreys attempting to breed in Northern Scotland. Your job is to deploy your wardens to try to keep people away from the next site, but at the same time, keep the public aware of ospreys. Lots of interesting accompanying blurb.

Boulder Dash
CBM-64
£8.95
Statesoft
★ ★ ★ ★

STATESOFT may be cashing in on Reagan's "new patriotism' by proclaiming themselves as American, big, bold and beautiful but *Your Computer* is quite happy to ignore this sort of vain blustering if the game itself is quite good, which Boulder Dash certainly is.

An enhanced Dig-Dug descendant — or transscendent, as some of the more excitable staff in our office would have it, Boulder Dash puts you in control of Rockford. This feisty little guy is really the star of the show. If you don't get him moving around the screen quickly, he starts tapping his foot and looking peeved. This is pretty dumb of him actually, since as soon as he does move, he is liable to be crushed to death.

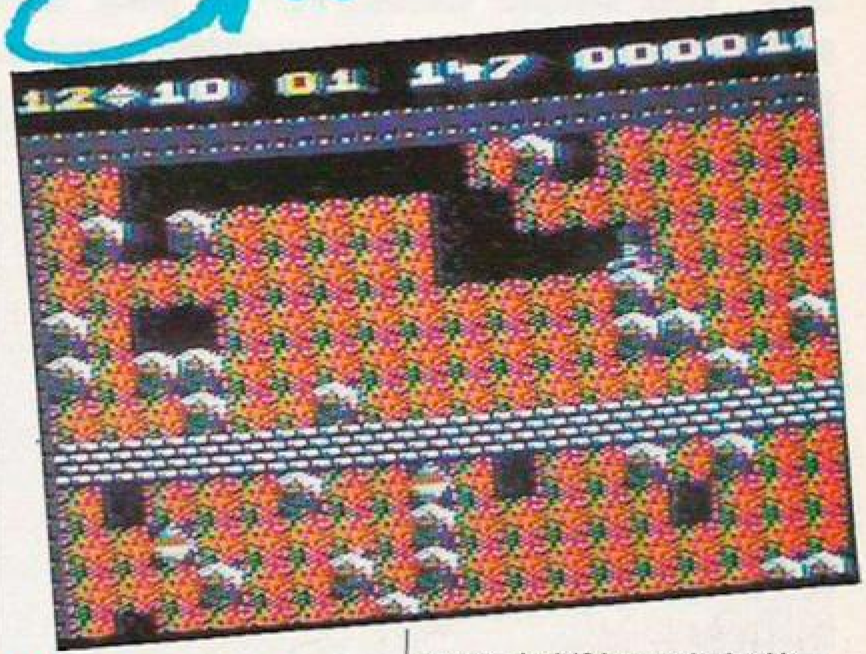
There are 16 mystical caves and five levels of difficulty. Some of the screens can be accessed directly without working through lower levels if there's an aspect of the game that particularly appeals to you.

On the first screen you start by tunneling around, grabbing all the flashing tokens on the screen and exiting to another screen within the time limit. Of course if you tunnel under a rock it will fall on you and kill you. In certain positions it is possible to start a landslide so that you, or rather Rockford, gets killed by a rock you may not have allowed for.

A rather American aspect of the game is that you should manipulate your enemies to ensure their downfall and the aggrandisement of your own personal wealth.

On one of the screens you have to play off a bunch of deadly subterranean butterflies against a relentlessly spreading green amoeba. Your puppet Rockford has to dig a hole to release the butterflies from their cavern and lead them to the amoeba without being killed. When the amoeba and the butterflies make contact, they turn into jewles for Rockford to collect. He can also turn the lethal lepidopterae into lucrative lapis lazuli by dropping rocks on them. Once Rockford has accrued enough crystal the magic escape tunnel appears, permitting him to escape to another zone.

Each level requires the development of new tactics in order to achieve high score, but play at all levels is rewarding and absorbing, rather than just plain awkward — in other words, this game has got playability and is worth the somewhat high price.



Mr Robot
CBM-64
£8.95
Beyond Software
★ ★ ★

POWER PILL grid, grab the pills; go left or right on the treadmills, bounce higher on the trampolines, mind the robot-hating alienfire and immunise yourself against them with energiser tokens. A platform game with a nice interactive difference: you can, should you be so minded, design your own Robo-test by pressing the F5 key. In designer mode, the screen puts up a small white cursor which you control by joystick.

You move the cursor down to select components as displayed at the bottom of the screen. You move the cursor over the component to be included in the game, be it treadmill, power pill (see above) and press the fire button. Move the cursor up on to the screen, press the fire button again and move the cursor to paint the object on screen.

There is a test facility which means you can check if the game is playable, but still go back and edit anything you don't like without scrapping the game altogether. You can also save your designs to tape or disc.

So the program is a kind of specialised, dedicated, even, games designer. The stock graphics are excellent. It is a great idea for cheats because you can shove hundreds of energisers on screen and only one alienfire.

In the main game your robot begins the Robo-test with five lives, one of which is lost every time he makes a mistake. During the Robo-test you will see bonus robot tokens which give you additional lives.

Boxer
BBC
£9.95
Acornsoft
★ ★ ★

BOXER IS an arcade/platform style game which owes much to the inspiration of the Popeye game and its various imitators.

(continued on page 61)

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Star★ chart

The Magic Roundabout

48K Spectrum
£6.95
CRL
★ ★

Twee little game in which Dougal must build a house before it is time for bed. He does this by pushing sugar lumps around and occasionally eating them to keep his strength up. Dylan the Rabbit and the other magic garden types hurt Dougal's nose if he bumps into them. Good idea, but could have been implemented much better.

Eureka

C64, Spectrum 48K
£15.50
Domark
Adventure
★ ★

Mammoth graphics adventure taking you from pre-historic times to the present day; five adventures plus five arcades which increase your strength for the adventures. Using clues in the adventures and the booklet illustrations, you must find clues to a phone number. The first person to ring the number wins £25,000. Good graphics, tortuous plots, even by adventure standards.

Country Cottages

Amstrad CPC-464
£8.95
Kuma
Bleed-'em-dry
★ ★

Corpulent, dark and neat, Miss Wisbanger aged 24 with two children and two dogs, far from being a character in a Margaret Drabble novel is just one of a coruscating host of interesting types you will encounter in this landlord simulation. Draws pretty pictures of cottages, you and your competitors decide on purchase, rent, and tenants.

The pictures are rather nice and the people whether enormous, hairy and rather nervous, or tubby, rosy, and rather shy, are amusing.

SOFTWARE Shortlist

(continued from page 59)

Our hero is in the gym preparing for the big fight. Unfortunately his mind has turned to other things; a young lady has entered the gym and is busy chucking balloons around. Old Meat-head here reckons that the way to any girl's heart is through her balloons, and goes about the mindless task of gathering up the balloons as they get stuck in the rafters. So far, so easy. Unfortunately for our man with the cauliflower ears, someone else has got the same idea.

Our friend here also seems to have a glass chin, so any fisticuffs with the rival are rather one-sided. Rather unsportingly, his rival is also slinging the equipment around. Various gloves, dumb-bells and hammers fly around and must be jumped, punched or dodged.

Good graphics and nice presentation fail to disguise a rather thin underlying plot, of rather limited appeal.

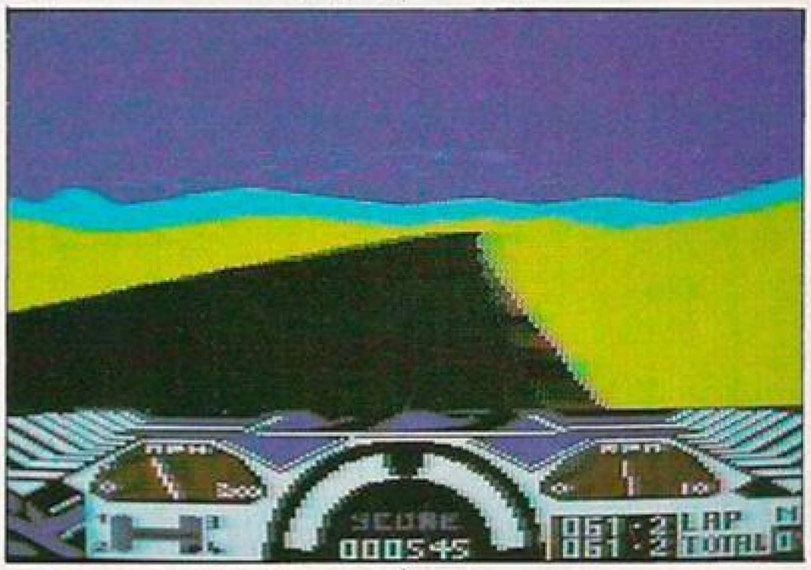
Turbo 64

CBM-64
£7.95
Limbic Systems
★ ★

THE FIRST HURDLE that confronts you in this game is the ingenious software protection. When the program has loaded, the computer asks you to indicate — by pressing the joystick at the right moment — certain colours as they are flashed up on the screen. When four colours have been entered correctly the check is complete and you are into the game.

Like Jet Set Willy the colours come on a grid-referenced chart. The computer gives you two co-ordinates, so you can locate the squares using a "simple" grid reference system. Unfortunately, the documentation omits to tell you which is the top and which is the side of the colour chart. Whilst the numbers on one side stretch down to 83, and the figures on the other side go only to 54, the example given on the documentation uses 5 and 7; these numbers occur on both sides of the grid and consequently can be read in two different ways. Pretty stupid, huh? We could tell you which is the top and which is the side, of course, but why should we do all the work for you?

It's a fast-load program, but not that fast, and having loaded it, it's probably going to take you at least eight minutes to battle through the software protection, bringing you up to the usual 16 minutes of fottling about before you can start playing.



The screen, when you finally get to see it, shows the traditional ribbon of tarmac stretching off to the horizon so beloved of Atari Pole Position racers. Instruments include rpm, mph and you can see the steering wheel revolving.

You have two circuits to choose from, and you can select manual or automatic gear control. Driving along the racetrack is very demanding since it is all too easy to oversteer. I would hazard that the addictive element of this game lies in being able to drive faster and faster as you gradually develop the co-ordination necessary to stay on the track.

This is potentially very exhilarating, rather like getting the M1 closed so you can zoom down it at top speed in your DeLorean without worrying about traffic. And whilst excellently implemented in all other respects, I would also hazard that the thing about motor racing is that you compete against other cars, as in the exciting scene depicted on the cassette cover which shows two powerful vehicles haring down the track at near-supersonic speeds. In fact, there are no cars to compete against. It just goes to show what a good job Atari did with Pole Position. If you're the sort of person who enjoys driving along the autobahn at three o'clock in the morning, you'll love this game.

Microgo 1

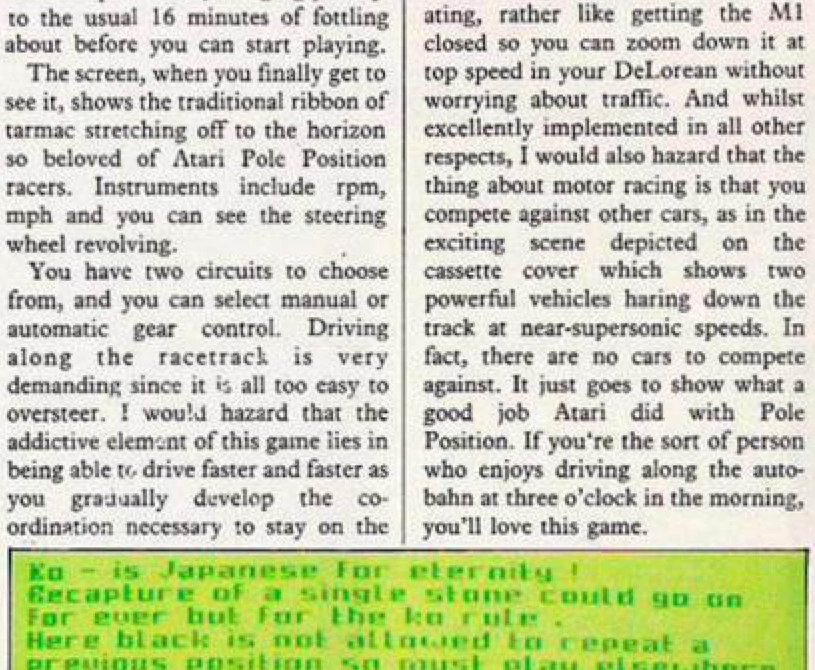
BBC
Edge Computers
★ ★ ★

GO IS A board game that is at least as old as chess and, arguably, even more demanding.

The rules of the game are extremely simple. Two players alternately place black or white stones on the intersections of a 19 by 19 grid. The idea is to cordon off as much territory as possible. As enemy pieces can be surrounded and lifted off it also a battle for the life and death of groups of stones.

So far it has proved almost impossible to program computers to play a decent game.

Edge Computers' program settles for a mini-version of the game played on a nine by nine board. Even so it plays a rather poor game. One of its most irritating features is that the program has no taste for the Go equivalent of hand-to-hand fighting: after establishing the skeleton of a good position it passes for several moves. It is easy enough then to dart in and snap up the computer's territory.



This reviewer — a mediocre player ranked 12kyu — was able to trounce the computer at the highest level, giving it a handicap of five stones.

BASIC LIGHTNING
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MACHINE LIGHTNING
LIGHTNING STRIKES AGAIN
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Totally dedicated to writing very fast, video games, BASIC Lightning is a is a fully structured extension to the Commodore BASIC which adds a staggering 200 reserved words. It allows up to five tasks to run concurrently (one in foreground and four in background). Most of the commands are dedicated to games writing and the sound and graphics commands are unparalleled. Procedures and PASCAL type structured programming commands are also a feature of BASIC Lightning.
As well as the Commodore's own 8 hardware sprites, BASIC Lightning has its own software sprites. Up to 255 can be defined with user selectable dimensions. These can even be several screens wide. They can be scrolled, spun, mirrored, enlarged or inverted with phenomenal speed and smoothness.
A Sprite Generator Program (written in BASIC Lightning) is also supplied and can be used to design, edit and store all your sprites for use in your main program.
White Lightning is a complete games writing package comprising a high level, Forth based, multi-tasking games writing language, the extended BASIC (see BASIC LIGHTNING) and a powerful sprite Generator Program. Programs can even be written in a combination of Forth and Commodore BASIC and the final program, which will run independently of White Lightning, can be marketed with no restrictions whatsoever.
The Basic Lightning part of the package can be used to experiment quickly and easily before the Forth program is developed.
The speed of White Lightning has to be seen to be believed and a full demo is included. As with Basic Lightning, hardware sprites are supported, together with 255 software sprites which can be scrolled, spun, reflected, enlarged or inverted.
MULTI-TASKING Without doubt the most powerful feature of the Lightning series of languages is the multi-tasking facility. This allows two programs to be run concurrently and makes those smooth landscape scrolls etc. effortless.
The BASIC Lightning Sprite Generator Program is also included in the package.
Commodore 64 Machine Lightning is probably the most advanced games writing utility available on any micro. It comes in 4 parts:
MACRO ASSEMBLER/ MONITOR/DISASSEMBLER This is probably the most comprehensive machine code development system available for the Commodore 64 with features too numerous to mention.
BASIC LIGHTNING BASIC Lightning, the multi-tasking BASIC is also provided to facilitate experimentation in preparation for later assembly.
SPRITE GENERATOR Used to develop all the graphics for the final game. The Sprite Generator has numerous functions including enlargement, rotation and reflection.
OBJECT LIBRARY This is Machine Lightning's most powerful feature. 10k of re-entrant code with more than 130 documented entry points. These are the routines that provide all the superfast graphics routines in White and Basic Lightning. They contain virtually every routine you'll ever need to write an Arcade Game and multi-tasking in Machine Lightning is covered in the comprehensive accompanying manual.
AVAILABLE ON TAPE OR DISK
Available from Boots John Menzies and all good software suppliers.
OASIS SOFTWARE
9a Alexandra Parade, Weston-super-Mare, Avon BS23 1QT. Telephone: (0934) 419921.
Every product carries a lifetime guarantee.
All prices include comprehensive manuals. VAT and p&p. (includes manuals and p&p overseas)
24-hour Access
Tele-ordering on (0934 419921)
Please send me the following Lightning System Pack(s)
Basic Lightning (tape) £14.95
(disk) £19.95
White Lightning (tape) £19.95
(disk) £29.95
Machine Lightning (tape) £29.95
(disk) £39.95
I enclose my cheque/P.O. for £
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The crystal ball

The Sorcerer of Claymorgue Castle from Adventure International is the latest from Scott Adams. You play Beanwick, an apprentice wizard; not only do you have the usual range of Scott Adams puzzles to contend with but must also learn how to cast spells. A sure-fire winner.

Modesty almost forbids me from mentioning two new books. Entitled "The BBC Micro Adventurer" and "The Commodore 64 Micro Adventurer", they are complete guides (solutions and maps) to four popular adventures. The BBC version covers Philosopher's Quest, Castle of Riddles, The Count and Voodoo Castle while the 64 version covers these last two plus Lords of Time and Heroes of Karn. Published by Duckworths at £3.95, they are in your shops now.

Century Software are releasing Legend, an adventure and strategy game for the Spectrum. It has animated graphics and over 120K of compressed text.

A helping hand

For players of Scott Adams Adventureland comes the following succour. If you're stuck in the bog with the blue ox statue, look below.

Something too heavy?
"NOYNUB" YAS :XO DNA EXA EHT YLNO YRRAC

Still stuck?
TUO MIWS OT EVAH UOY

Blade of Blackpool owners, help is nigh.

Flummoxed by the quicksand?
HTRON RO TSEW TSAE MIWS

Man-eating plant a problem?
SEEB EHT TI EVIG

Yours in swamp and sorrow,
HUGO NORTH

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

Flight from the Dark

48K Spectrum
£8.95
Five Ways Software

BASED ON the Popular Lone Wolf role-playing books comes a new series of adventure programs. The first two are Flight From The Dark and Fire On The Water. They are superb.

The games are a mixture of beautifully presented text and graphics, the latter being cleverly animated. Each adventure starts in the same way: you train as a Kai Lord to develop fighting prowess and endurance before setting out on your quest. As you progress through the adventure, you are able to call upon, learn about and develop many other Kai Disciplines. These special abilities include sixth sense, healing, tracking, weapon skill, animal kinship, telekinesis, mindshield and mindblast.

In Flight From The Dark, your mission is to wreak vengeance on the Darklords for the massacre of the Kai Warriors. You are the last of the Kai — you are now the Lone Wolf.

During your journey, you will be able to use any weapon you find or may choose to fight with your bare hands. Once in combat, a number of movements are at your disposal. You can step forwards or backwards, chop, swipe, thrust, parry and use your mindshield and mindblast powers. If all else fails, you can always run away!

The screen display, magnificently framed and looking like a parchment, is divided into two, the top half showing an imaginative and colourful scene, the bottom half being used as a scrolling text area.

Commands are given by selecting an option from one of several given at each stage. Lone Wolf, whom you guide through the adventure, is an impressively animated cloaked figure. When he leaves one scene and enters another, you may select from the options as soon as he stops walking. Once in combat, you are fully in control. To help you learn the single-key commands, a keyboard overlay is provided.

The game comes complete with the paperback, although the latter is not essential for playing the game. However, the book does contain greater detail. To assist you, the program provides the scene reference number so you can look it up in the book if you wish. A great idea and extremely well implemented, the scene number appearing in the head of a bull to one side of the screen.

A great deal of thought and professionalism has gone into the making of these games. For example, as well as being able to save the game at any one of many stages — a cassette symbol always appears as a reminder — you can also save and transfer your Lone Wolf character from one game to another in the series.

While the books are very entertaining in their own right, the programs are even better. Everything about these games reeks of quality, from the presentation of the text to the excellent graphics, from the clarity of the instructions and cassette inlay right down to the provision of an overlay. Super stuff — can't wait for the next ones!

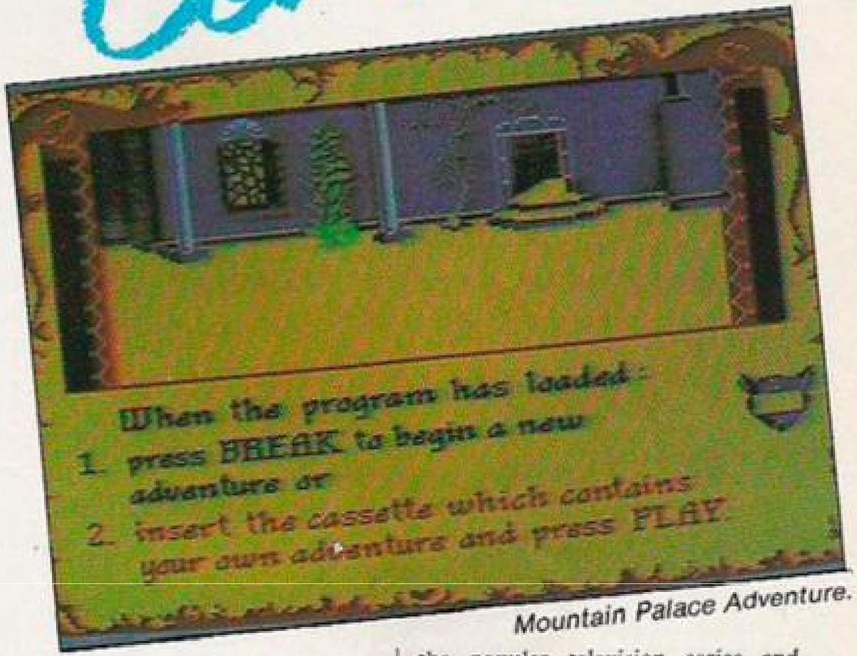
The Key to Time

48K Spectrum
£5.95
Lumpsoft

DR. WHO ADDICTS will welcome this Quilled adventure from quirkily named Lumpsoft — the logo is the 'uneven road ahead' sign.

This textual quest centres around the popular television series and features characters that will be well familiar to all Tardis watchers. The Doctor must seek out the parts of the Key To Time and save the universe — a trivial task, eh? There are plenty of puzzles and the adventure has a good cohesive feel to it. The vocabulary is quite comprehensive and response time is fast.

Hint facilities are built into the program — typing "Help object" may reveal a clue for that specific item. Good humoured and attractively presented, TKTT is certainly worth your consideration. Their next release sounds even more interesting — it's called Malice In Wonderland!



Mountain Palace Adventure.

Mountain Palace Adventure

Commodore 64
£7.95
Duckworth

TEXT ONLY, Mountain Palace Adventure offers a more traditional mission. You have heard rumours of vast wealth to be gained by anyone bold enough to penetrate the sinister Mountain Palace. Naturally, being both curious and greedy, you set out to acquire some of this lolly.

There are some strange inhabitants in the Palace. A headless ghost will cause you no end of trouble but if you are unfortunate enough to be killed, the game thoughtfully allows you to be brought back to life in the same spot where you met your end.

Some of the objects you find are stranger still. For example, what use will you make of a spinning top, a fishing rod and an old bone? A jolly romp in the classic mould.

SPECTRUM SOFTWARE SURVEY

Paul Bond dies in a shoot out with the Wild Bunch.

I ENTHUSIASTICALLY ran all this software on our shiny new ZX Spectrum with the real "professional" keyboard. It's not clear exactly what is meant by a professional keyboard but maybe it's something to do with the high drop-out rate in demanding professional vocations, because the keys certainly like to drop out of this machine. So you can imagine it was with some trepidation that I tackled the ancient art of Kung Fu with the aid of my trusty Sinclair. Kung Fu is normally only practised by micro owners when they have carefully explored all the other methods of getting a program to run.

Bug-Byte's delightful program mirrors perfectly the balletic movements of this martial art. Two figures sketched in white against a blue background do battle in a Chinese room. The computer can be your opponent or you can play a friend without discovering how readily his or her teeth fall out. By pressing keys 1-4 you can get your man to kick, chop and punch his way across the screen. There is a nice touch of the Jimmy Hills, too — I don't mean the characters' beards; you can have an action replay of the moves leading to a fall. Nice one Bug-Byte: who knows, perhaps they'll bring out games that take you all the way through Hsing I, Pa-kwa, all the way up to T'ai-chi.

Aggressive foreign types also feature in another Bug-Byte release, Turmoil. Oil is what it's all about: this is a platform in which you have to steer Mic the mechanic around the screen, grab a jug, catch drops of oil from a dripping tank, and refuel the car "before it's too late". Meanwhile, shake the sheikhs' intent on slicing you into shish-kebab with their shimmering swords.

Good fun, 26 levels, but in the final analysis, it's just another platform game. And when I loaded up ESP's Moonlight Magic, dear reader, you can imagine how depressed I was to discover that that was just another platform game, too. Particularly since the cassette inlay had beguiled me with words like "entirely NEW arcade game".

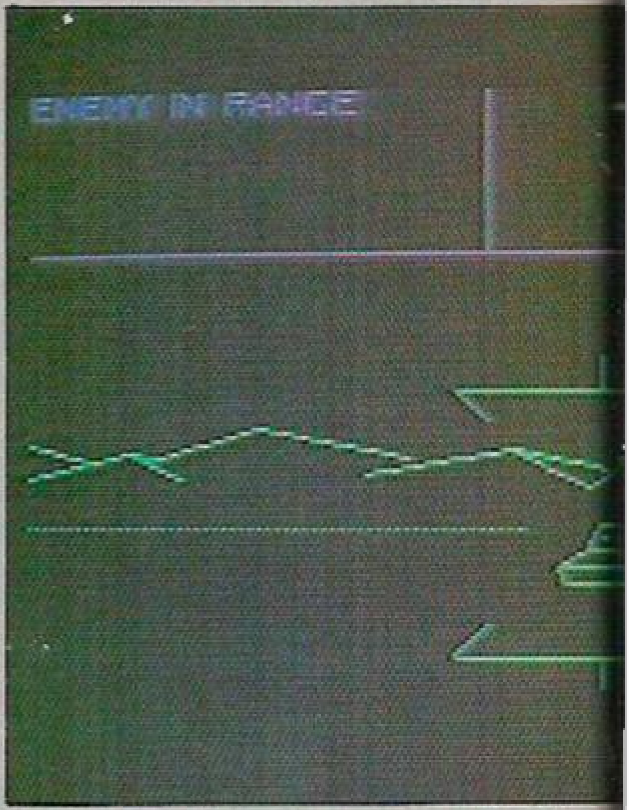
You must climb the ladders and walk the scaffold, avoiding the ghosts and ghouls that haunt the house. Fill your brush from the paint pot and paint the house "before it's too late." Yeah, well. It stars Mack the Brush, but I was tempted to give it the brush-off.

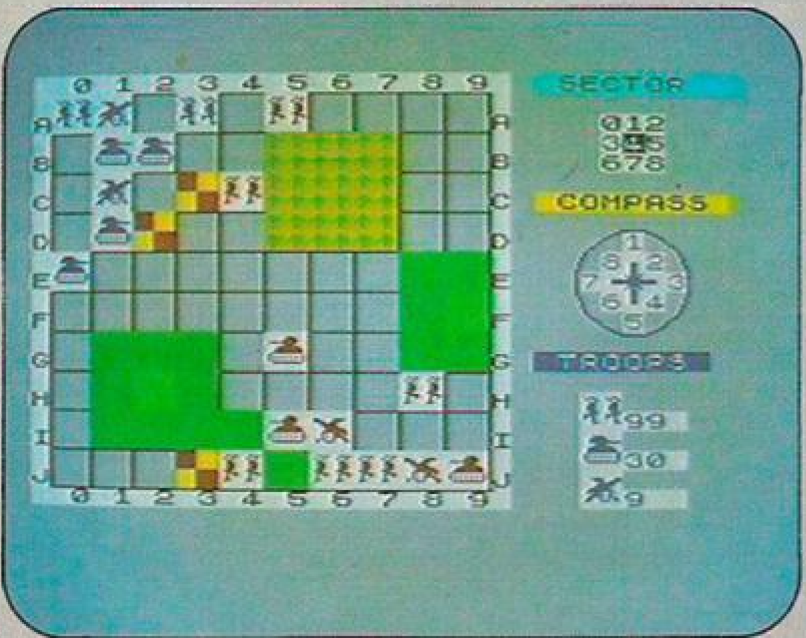
ESP redeemed themselves somewhat in my eyes, and no doubt in the eyes of He who watches over the impecunious but gullible software purchaser, with an interesting game with a Biblical slant. In Noah, it is the last three of those days which can safely be described as antediluvian. Yes, three days before the flood, and you've got to find 31 pairs of animals hidden within 256 screens.

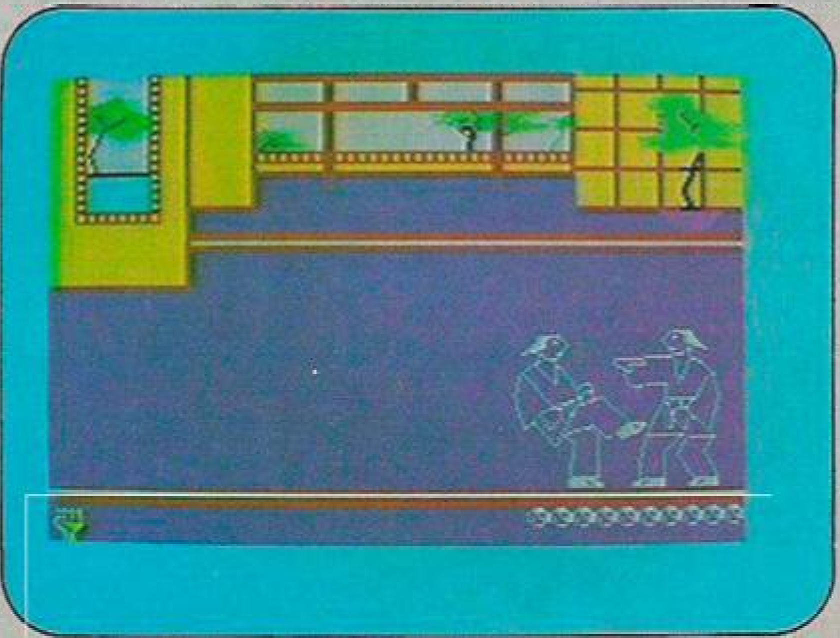
Noah is sketched in black and looks like he just came off the Sunday school wall, crook and all. Shepherd's crook, that is. You have to eat food — shepherd's pie? — to get the strength to move onto the next screen. Dodge puddles, rivers and rocks thrown by the unbelieving populace. You can call up a map which shows your location in the game and the number of lives left.

There is plenty of ground to cover from the badlands to the monster maze and, natch, the caves. The animals are particularly well drawn, though where the descendants of the two giant beavers that I rescued are hanging out today is a secret between them and their maker.

Right: Battlezone from Quicksilva. Below from left to right: War Zone from CCS, Kung Fu from Bug-Byte, Stagecoach from Creative Sparks and Turmoil from Bug-Byte.



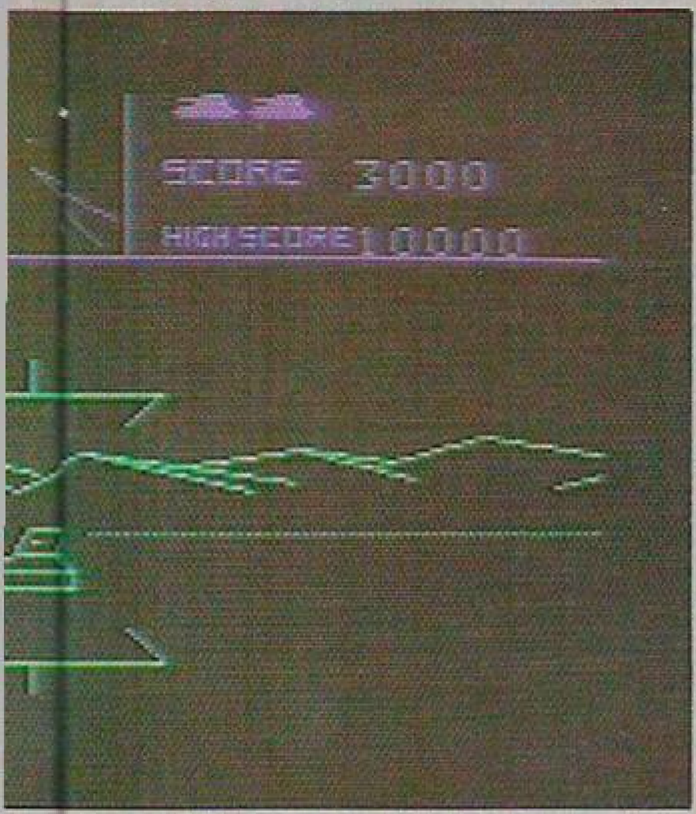




Noah's rescue job might have been easier if he'd found a helicopter. Omega, those nice people who bring you other people's old software at rock-bottom prices have got hold of CRL's Copta and released it as Chopper. It doesn't bear too much resemblance to the Choplifter archetype — no sideways scrolling — but you can rescue your buddies while taking potshots at passing enemy eggbeaters and jets. A good value, shoot'em-up.

War drags on in a Quicksilva implementation of that old Atari favourite, Battlezone, by Bill Witts. The screen has a section at the top which warns you when the enemy is in range, a radar plot of objects in your sector and a high-score. You're driving a tank, of course, and squinting through the fire slit at the truly incredible, given the limitations of the machine, 3-D display showing hostile vehicles built out of matchsticks whose one aim is to see you don't live till chow time.

Nice touches like the individual control of caterpillar tracks make this a must for anyone thinking of buying a tank. Tanks and other material feature in CCS's War Zone, which sounds like it ought to be a song recorded by the Vibrators, or something. You're the Blue Army, the computer is the Red Army — no



Russian dancing or choruses of Kataschok here, however. The screen displays a 10 by 10 grid which is one of nine sectors of the war zone. The right-hand side of the screen displays a nine by nine grid, with the area you are looking at clearly indicated. Below this is a reminder of which keys to move forces in any direction.

The computer has first move; this is a little disconcerting to the first-time user, especially as it seems to go on for so long. But in war the waiting is the worst part. Finally the computer puts up "Command" on the screen which means you can have a go. In this mode there are eight commands you can use, counting saving the game, ending the go or just giving up altogether.

If you're firing from square G7 to square G9, you type in FG7G9 and wait for the result. If you want to move from G7 you type in MG7 and the computer tells you how many squares you can move. You then input the moves using numbers corresponding to the compass rose on the right hand side of the screen. To end your move you can call in an airstrike.

Purple and blue stagecoach

Airstrikes were the least of a cowboy's problems in the Old West. Stagecoach from Creative Sparks claims to be all thundering hooves and Indians and I imagine a thundering Indian would be pretty frightening. Written not by J T Edson but by J T Harris, the game gives you a keyboard definition option, but some of the other de luxe functions like quitting the game, and displaying the score, don't work as indicated in the cassette inlay.

The game is divided into three sections, the Jump, the Mountains, and the Indians. The driver of the stagecoach has been shot and you must get on board. This is the Jump. The screen displays a yellow desert, green cacti, and a purple and blue stagecoach — typical Californian colour scheme. You must gallop up behind the stagecoach, using the keyboard — or joystick — to control your horse. Press fire to jump and hopefully you're on board before all six passengers fall out.

If not, the game ends. Once in control you must collect any passengers who parted company with the coach. Then off to the mountains. As you drive the stagecoach through the mountain passes you have to dodge rockfalls — I thought these were flocks of birds at first. Occasionally you see boxes of gold or ammunition on the ground which are collected by steering over them.

Finally, the Indians. They try to ride one each side and one in front while a fourth kidnaps the passengers. Bit more lively than the old National Bus Company, eh? The Wild Bunch is an offering from Firebird, one of British Telecom's little money spinners, doubtless of great interest to the greatly-reduced number of the British public who have actually been silly enough to pay money for shares in something that they already owned anyway.

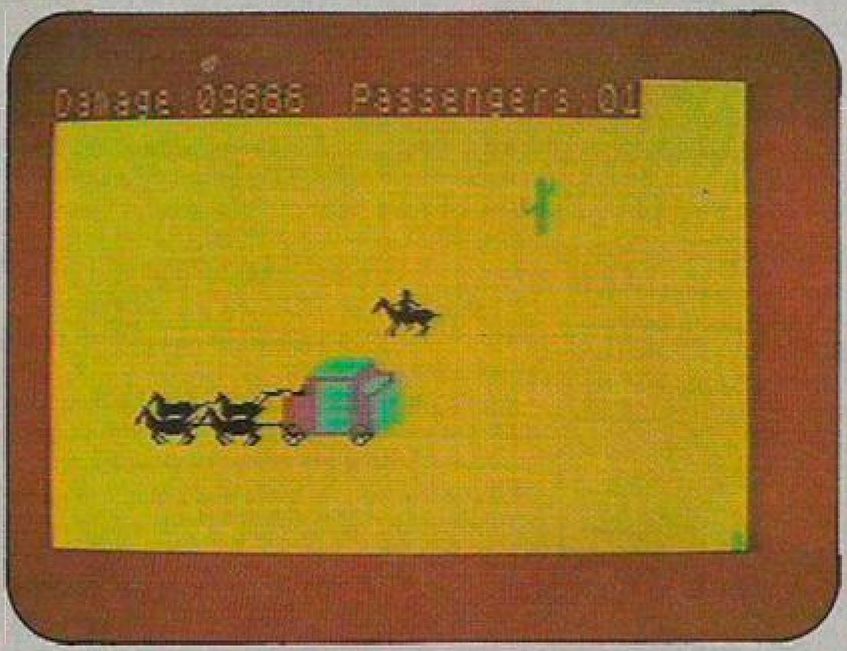
This is really a very good game and bodes well for the project. The covering letter with this software had a touching reference to problems with loading and bugs in some of the games "due to our software protection systems". How true, how true. We get quite a few commercial games that have been protected from being played, let alone copied. No problems with this one, however.

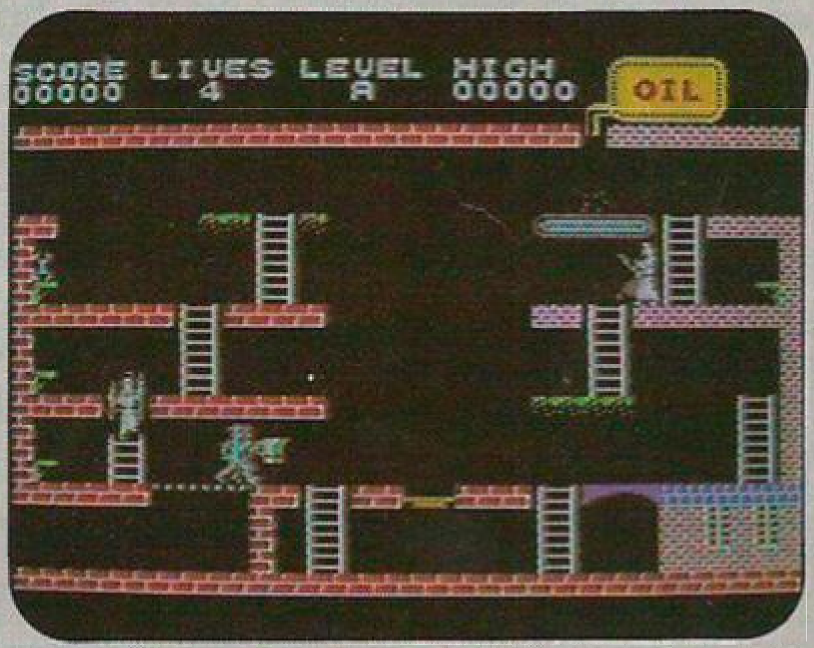
It is a prompted text adventure with some graphics in the style of Automata's Groucho. It plays "Do not forsake me oh my darling" and greets you cordially: "Howdy, pardner! What name do you go by?"

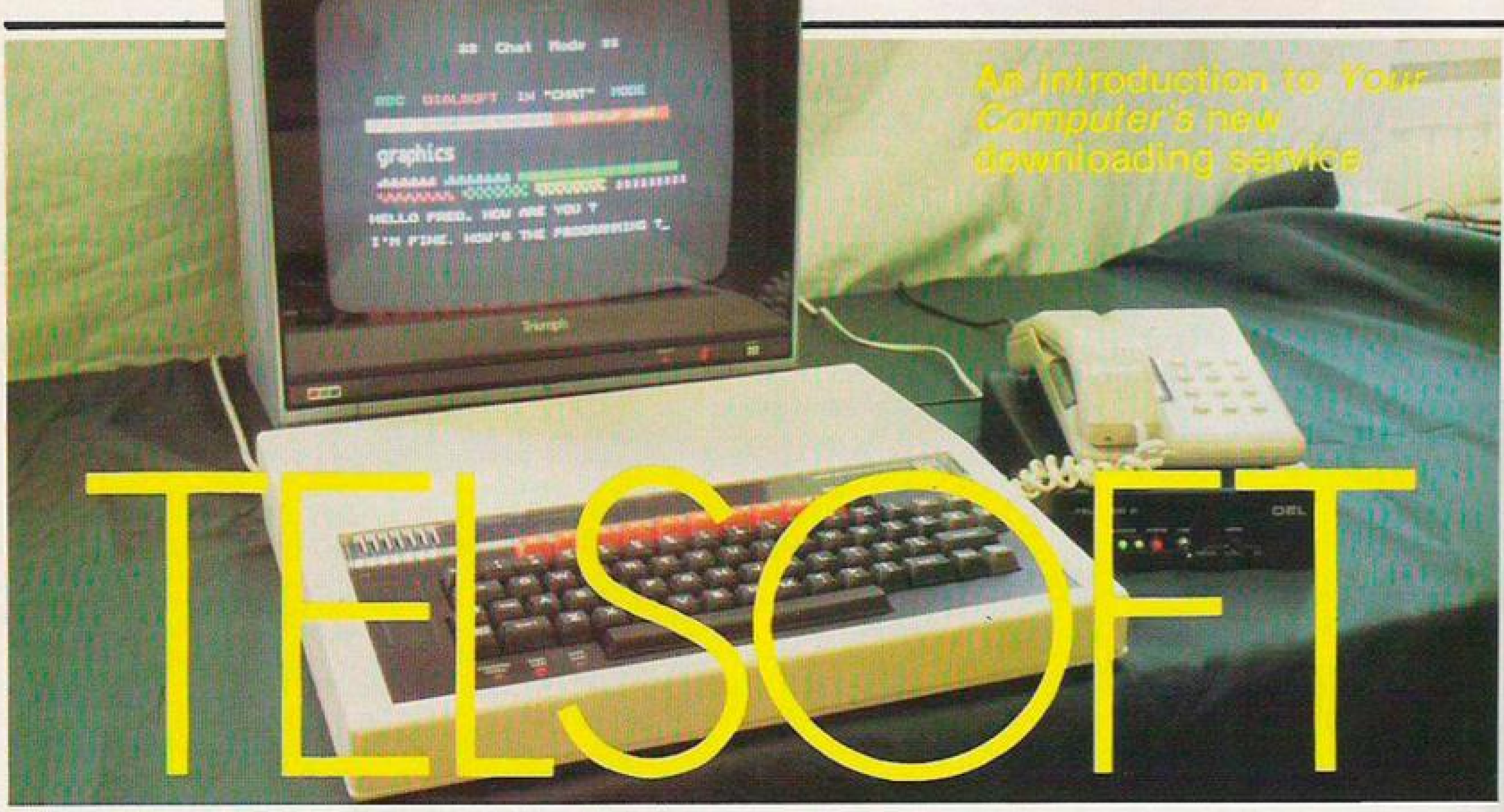
Written by Kevin Smith — not a name you would associate immediately with the days of gunfighters and outlaws — the scenario has you implicated as a man's killer. Your only chance to prove your innocence is to find the real killer, a member of the dreaded Wild Bunch.

You can call up a map of five towns from Dodge City to Dry Gulch as places to hunt down the Wild Bunch. You get your first ride for free, but on second journey from Dodge City to Nugget City, I was attacked several times, using up my strength points. Charged by a cruel, desperate buffalo, you can run, fight or bribe. Have you ever tried bribing a buffalo? The computer doesn't allow it. I offered a Red Indian a bribe, too, but he was so disgusted he took my Colt 45.

This led to my demise in the end because I later called out a man with a patch on his left eye. The screen showed the mean hombré going for his gun, I punched the keyboard — nothing happened. Then the screen put up the message: "You went to the great ranch in the sky — you didn't have a gun!" ■







TELSOFT

An introduction to Your Computer's new downloading service

A MODEM LINK to the telephone network opens up many possibilities for computer users ranging from access to simple bulletin boards through a variety of user-to-user communications, including electronic mail, to the use of complex interactive databases such as Prestel. This article introduces Telsoft, a new software package which offers a number of additional facilities.

These include a quality program for communicating between home computers, and a totally new method of downloading software which is specifically designed to transmit single programs to many users simultaneously using low cost hardware.

The idea for the Telsoft downloading service came from one of the many *Your Computer* users who find it increasingly difficult to type in accurately the listings of published programs as their quality, and hence complexity, increases. As the package was developed, it rapidly became evident that there was also a need for a compatible computer communications package, particularly for working with 1200/1200 bit/s half duplex modems where information only flows one way at a time, and in consequence the scope of Telsoft was extended.

The Telsoft program downloading facility is being trailed by *Your Computer* magazine with both hardware and software support from British Telecom — BT. The service will be provided initially by downloading selected programs for the BBC and Sinclair Spectrum computers from listings published in *Your Computer* magazine.

The "receive" section of the BBC and Spectrum Telsoft packages are published in this issue of *Your Computer* so that readers with the appropriate computers and modems can try the service out now.

The full Telsoft communication package will also be available in due course from the downloading service. It is hoped that many readers will try out the total package in order to determine the reliability of the computer — computer "Chat" and "Data Transfer" modes

as well as that of the downloading service.

The purpose of the trials is to determine the reliability of the protocols adopted to detect and subsequently correct the vast majority of errors that may arise during downloading or data transfer between computers. However, the error checking procedures adopted in the software developed to date have had to be kept relatively simple in order to minimise the length of the programs.

While programs that will be available on the downloading service will be advised in the magazine — with appropriate instructions to Save and Run the software, it will also be necessary for anyone intending to download software to know on which days particular programs will be available. This information will be given on new BT Audio Recorded Information Service, which will be known as Microline, and which will initially be available on Colchester (0206) 8068.

This will obviously be a speech-only service and will advise micro users on a range of BT computer services, will give details of the telephone numbers of the *Your Computer* 300 bit/s and 1200 bit/s downloading services, and the programs available on this service and will also give advice on how to procure a modem for your computer.

The early stages of developing software for the BBC, Spectrum and Commodore 64 computers have revealed a number of difficult compatibility problems between modems and computers and it has only been possible to test out the software with specific equipments. As part of the ongoing development we will be looking to all *Your Computer* readers who are programming experts to try out this software, to advise us of any bugs and, hopefully, to suggest the modifications necessary to overcome any compatibility problems.

To date, the software has been trialled with the OE Ltd Telemod 2 modem, working to BBC and Commodore computers, and the VTX5000, working to the Spectrum. These are both 1200/75; 1200/1200 bit/s — half duplex — modems, but the BBC software has also been tested successfully with a range of 300 bit/s modems.

The range of Telsoft programs that have been developed for the BBC, Spectrum and Commodore computers all have the same protocols and menu displays. Full details of the chat, transfer and receive modes are as follows:

Chat mode: This mode allows for a conversation between the two users so that anything either end types appears on both screens. Since either end can type at any time automatic carriage returns are generated when necessary to prevent text from both ends appearing on the same screen line.

Audible warning — typewriter bell — is given when only six characters remain on the current screen line. The delete key still works, although only on the current screen line so if you make a mistake and type onto the next line before noticing you won't be able to erase it.

The BBC is in Mode 7 during Chat mode, which gives access to seven colours and all the Teletext graphics. To obtain all these features, use the function and cursor keys, both with and without Shift.

When you want to leave Chat mode simply press Ctrl — or Symbol Shift — and G simultaneously. An audible tone is given and the Telsoft program reverts to its main menu. This is repeated at the distant end so that neither end gets lost.

Transfer mode: This mode involves copying an area of memory from one computer to another. The information being sent can be a

Basic program, some machine code, a data file or even all three. The only restriction is that the screen itself cannot be copied as the Telsoft program writes on screen during the transfer. Naturally, two software procedures are required — one to transmit and one to receive the information; this section describes the general principles and procedures adopted, whilst the following two sections explain the receive and transmit procedures.

The Telsoft program transmits data in blocks of up to 256 bytes, together with a 26-byte

(continued on page 69)

Figure 1.

```
10 REM HEX CODE LOADER
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)":A$
40 A=EVAL("&"+A$)
50 IF A)&6F87 THEN 280
60 IF A(&2A00 OR A)&6FE7 THEN 20
70 PRINT ~A" ":
80 INPUT ":" B$,C$
90 IF LEN(B$) ()16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6F87
290 END
300 E=0:IF ASC(X$)(48 THEN E=1:RETURN
310 IF ASC(X$)(58 THEN RETURN
320 IF ASC(X$)(65 THEN E=1:RETURN
330 IF ASC(X$))71 THEN E=1
340 RETURN
```

Figure 2.

```
6A00 :A9C8A0FEA20120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F00BC934F0E9C9,4CB
6A18 :35F0064C0C6A4C47,280
6A20 :6AA90C20E3FFA9E8,4B2
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A20220F4FFA9C8A0,4C8
6A40 :FEA20020F4FF60A9,4BC
6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA080,3EB
6A58 :A9FF8899856FD0FA,587
6A60 :A915A20120F4FF20,394
6A68 :0C6C90FB200C6CB0,34B
6A70 :FBA0008477847884,416
6A78 :79847A847B857020,38B
6A80 :D56DA57029F0C980,4B9
6A88 :D0E2200C6CB0D899,46B
6A90 :7100C820D56DC009,364
6A98 :D0F0A000A5742980,422
6AA0 :D00BA51C857618A5,354
6AA8 :1D6573857720 0C6C,289
6AB0 :B0B520E3FFC820D5,524
6AB8 :6DC010D0F0A57320,435
6AC0 :B26D200C6CB0A0C5,3CC
6AC8 :7AF00BA95820E3FF,478
6AD0 :20E7FF4C676A200C,34F
6AD8 :6CB0BCC57BF00BA9,48C
6AE0 :5820E3FF20E7FF4C,4AC
6AE8 :676AA573A8B9856F,43E
6AF0 :D00E20E7FFA90B20,3B8
6AF8 :E3FF4CB36B4C676A,469
6B00 :A000847A847B200C,2C9
6B08 :6CB0F2917620D56D,477
6B10 :C8C475D0F1200C6C,45A
6B18 :B0E3C57AF00BA958,4CE
6B20 :20E3FF20E7FF4C67,4BB
6B28 :6A200C6CB0CFC57B,3C1
6B30 :F008A95820E3FF4C,447
6B38 :676A20C76B20E7FF,429
6B40 :A573A8A90099856F,3F6
6B48 :A58AC902D05820D7,419
6B50 :6BA9C820556CA955,3BB
6B58 :20306EA950205 56C,298
6B60 :A915A20120F4FF20,394
6B68 :F76BA471C888B985,505
6B70 :6FD05198D0F7A90C,4A4
6B78 :20E3FF20A56DA95A,437
6B80 :8582A96F8583A907,3D7
6B88 :20006E20F86D20A8,2DB
6B90 :6DA905200 06EA988,2DA
6B98 :20E3FF20F86DA9D2,502
6BA0 :20E0FF4C0C6AA955,3BF
6BA8 :20306EA99620556C,2DE
6BB0 :4C6A6BA475200C6C,2D2
6BB8 :8BD0FA200C6C200C,316
6BC0 :6C4C486B4C6C6AA9,336
6BC8 :2020E3FFA96F20E3,43D
6BD0 :FFA96B20E3FF60A9,51E
6BD8 :9CA000A68AE002D0,41E
6BE0 :0BA21320F4FFA212,387
6BE8 :20F4FF60A29720F4,4C0
6BF0 :FFA29620F4FF60A9,553
6BF8 :9CA000A68AE002D0,41E
6C00 :EBA25320F4FFA252,4E7
6C08 :20F4FF6018A99685,44F
6C10 :8F847EA991A20020,38D
6C18 :F4FFB009C007D005,448
6C20 :6B684C0C6AA47E20,2D4
6C28 :496CC68FD0023860,374
6C30 :A58AC902D0062079,369
6C38 :6EB0EC60A991A201,447
6C40 :20F4FF98A47EB0DF,55C
6C48 :608AA2D2CAE8CAD0,5AA
6C50 :FBAA60A900847EA8,458
6C58 :20496C88D0FAA47E,449
6C60 :60A9E8A000A2FF20,452
6C68 :F4FFA900858AA90C,460
6C70 :20E3FF20A86DA904,3E4
6C78 :20006EA9098582A9,2F0
6C80 :6F8583A00020F86D,39C
6C88 :20156DC941F00BC9,370
6C90 :42F011C943F0174C,3A2
6C98 :616CA908A20120F4,335
6CA0 :FF4CB76CA908A203,3C4
6CA8 :20F4FF4CB76CA908,433
6CB0 :A20420F4FFE68AA5,4CE
6CB8 :7C20E3FFA47E20AB,46B
6CC0 :6DA90820006E20F8,2C4
6CC8 :6DA01720156DC941,2D0
6CD0 :F00BC942F011C943,413
6CD8 :F0174C616CA907A2,372
6CE0 :0120F4FF4C096DA9,37F
6CE8 :07A20320F4FF4C09,314
6CF0 :6DA907A20420F4FF,3D6
6CF8 :E68AA58AC902D009,443
6D00 :A9E8A000A20120F4,3E8
6D08 :FFA57C20E3FF2053,495
6D10 :6C20536C6020AB6D,2E3
6D18 :A90520006E20F86D,2C1
6D20 :20AB6DA90520006E,274
6D28 :20F86D20AB6DA905,36B
6D30 :20006E20F86D20AB,2DE
6D38 :6D847EA90320006E,2A9
6D40 :A9D220E0FF857C60,4DB
6D48 :A90C20E3FF20AB6D,3EF
6D50 :A90720006EA99A85,306
6D58 :82A96E8583A00020,361
6D60 :F86D20AB6D20996D,3C0
6D68 :20996D20996D20AB,317
6D70 :6DA90A20006E20F8,2C6
6D78 :6D20AB6DA9022000,270
6D80 :6E20F86D20AB6D20,34B
6D88 :E7FFA9D220E0FF48,5A8
6D90 :A90FA20020F4FF68,3D5
6D98 :60A90820006E20F8,2B7
6DA0 :6D20AB6D6020AB6D,33A
6DA8 :20AB6D20E7FF20E7,445
6DB0 :FF604829F0696A6A,3FE
6DB8 :6A0930C93A300318,1F1
6DC0 :690720E3FF68290F,312
6DC8 :0930C93A30031869,1F0
6DD0 :0720E3FF60457B85,3AE
6DD8 :7BA208A57B2A900C,30B
6DE0 :A57B49088578A57A,390
6DE8 :4910857A267A267B,299
6DF0 :CAD0E86020E3FFC8,5AC
6DF8 :B182C90DD0F6C860,4F7
6E00 :867DAAA92020E3FF,478
6E08 :CAD0FAA67D60C97F,55F
6E10 :D00BA98620F4FFE0,4FD
6E18 :00F012A97FC920B0,3C3
6E20 :0EC90AF00AC90DF0,3A1
6E28 :06C907F002A90060,2D1
6E30 :857C867D847EA991,440
6E38 :A20120F4FFA903A2,404
6E40 :0720F4FFA996A208,403
6E48 :20F4FF982902F0F4,48A
6E50 :A47CA997A20920F4,41F
6E58 :FFA903A20420F4FF,464
6E60 :A991A20020F4FFB0,49F
6E68 :09C007D00568684C,2C1
6E70 :0C6AA57CA67DA47E,3DC
6E78 :60847E867DA996A2,446
6E80 :0820F4FF982901F0,3CD
6E88 :0BA996A20920F4FF,408
6E90 :9818900138A67DA4,340
6E98 :7E60444F574E4C4F,2B1
6EA0 :4144494E47204D45,215
6EA8 :4E550D3120202052,193
6EB0 :4543454956450D34,1F2
6EB8 :2020205345542042,1AE
6EC0 :6175642052617465,2E6
6EC8 :0D35202020455849,188
6ED0 :5420544F20424153,20D
6ED8 :49430D454E544552,217
6EE0 :204E554D4245520D,1F6
6EE8 :2820555345204354,1EC
6EF0 :524C2D4720544F20,1F5
6EF8 :5245545552 4E2054,254
6F00 :4F204D454E552029,1ED
6F08 :0D53455420545241,200
6F10 :4E534D4954204261,24E
6F18 :756420526174650D,292
6F20 :4120202037352042,16F
6F28 :6175640D42202033,1FC
6F30 :303020426175640D,209
6F38 :4320313230302042,188
6F40 :6175640D53455420,253
6F48 :5245434549564520,223
6F50 :4261756420526174,2C3
6F58 :650D50524F475241,23D
6F60 :4D20204C4F414445,1F2
6F68 :4420206F6B0D5052,20D
6F70 :4553532041 4E5920,213
6F78 :4B455920464F5220,210
6F80 :4D454E550D202020,1A2
```

THIS PROGRAM is approximately 1400 bytes in length and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape or disc before you Run it. When the hex loader program is run the computer will give the prompt "Start address (hex)?" and you should enter 6A00 and press Return.

The computer will print the start address of the line and then one space followed by a colon — eg: 6A00: — you then have to enter everything after the colon from the relevant line in figure 2 and press Return at the end of each line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder ready to record before starting to type in the machine-code section.

The machine-code program can be loaded and run automatically each time you call the downloading service by entering the command

*RUN "DOWNLOAD" (Return)

Provided that all of the machine code is correct you will be asked to select the transmit and receive speeds. For the OE Ltd Telemod 2 modem simply select Option C for both. You will now see the Download Menu with three options numbered 1, 4 and 5.

To receive software from Telsoft, the *Your Computer* downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone numbers to ring for the 300 and 1200 bit/s downloading services.

When a program you want to download is available, make sure your modem is correctly set up and dial up the telephone number appropriate to your modem's speed. When you hear the modem tones switch the modem to line and replace the receiver.

Select Option 1 from the menu — Receive. As each block of data is received the block number and the program title will be displayed, followed by "OK" if there were no errors. Note that the "OK" will be missing from any blocks in which errors are detected and that the downloading program will wait for these blocks to come round again in order to make a second attempt to load.

When all blocks have been loaded, the "Program loaded OK" message will appear; after which, pressing Ctrl and G will return you to the Telsoft Menu. Then select Option 5 to leave the Telsoft Menu and return to Basic and Save and Run the program as required.

The full communications package will be made available on Telsoft within the next month. This is a longer machine-code program which, in its current form, uses locations 7000 through to 7BDB and contains Chat, Transmit and Receive modes. It can also be used in place of this program when you are downloading future programs from *Your Computer* service using just the Receive mode, the operating instructions being the same as for this program. Note, however, that the full Telsoft package starts at location 7000 hex, whereas the downloading section contained in this article starts at 6A00.

GHOSTBUSTERS™ THE COMPUTER GAME.

BY DAVID CRANE

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Yes. Ghostbusters is a computer game, too.

The game play follows the film with incredible accuracy. Even down to the chart-topping music score.

Your task is to rid the world – and in particular New York City – of a cataclysmic plague of ectoplasmic nasties.

Play it well and we give you a Ghostbusters franchise – with your own secret account number. Use this number and the money it brings you, to buy the same ghost busting gear they had in the film. (Don't worry – we'll give you some money to get started.)

You will have earned it. And you can use it to go to undreamed of levels. Don't try to use someone else's number, we'll find out.

From then on, it's you against the ghosts. All the way to the Temple of Zuul.

Where the final battle begins...

Designed by USA's David "Pitfall II and Decathlon" Crane and running on Commodore 64 cassette and disk and Spectrum. Coming soon on other systems.

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(continued from page 67)

header. To each of these a two-byte error — cyclic redundancy — check is added so that errors can be detected and false data ignored. If errors do occur the faulty block is sent again until the distant end confirms that it has been correctly received. The header includes a 16-byte title — provided by the sender — and 10 bytes of control information.

Each block — plus header — is separated from the next by a gap of approximately half a second. This make it possible for faulty blocks to be retransmitted and also for Telsoft to receive a program from an endless-loop transmission starting from any block and continuing until all blocks have been received. This is the method of transmission utilised by the downloading service and the instructions for receiving this format are given in the next section.

Each block in a transmission may be part of a Basic program or part of a machine code or data area. Basic programs are automatically placed by the receiving computer in its own Basic area, which makes it possible for different varieties of the same make of machine to swap programs.

Because machine code may contain instructions to jump to a specific address, this type of block cannot be relocated by the receiving computer and must be placed in the same area of memory that it came from. In this case the data address is included in the 10 bytes of control information heading each block.

A point to note here is that many Basic

(continued on page 71)

Figure 1.

```
  5 REM SPECTRUM 48K      fig 1
 10 REM Hex Code Loader
 20 POKE 23658,8: CLS : PRINT
 30 INPUT "Start Address ";a
 50 IF a>61135 THEN  GO TO 280
 60 IF a<60000 THEN  GO TO 20
 70 PRINT a;
 80 INPUT " :";b$
 85 IF B$="END" THEN  GO TO 280
 90 IF LEN b$<>20 THEN  GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN  GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN  GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205  GO SUB 300: LET y=y*16+x
210 IF e=1 THEN  LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN  PRINT ":";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN  LET e=1
320 RETURN
```

Figure 2.

```
60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66EDCD,631
60016 :BBEDFE31CA99EAFE,692
60024 :BBEDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D0
60040 :15ED3EFACDB4EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,58C
60064 :803EFF121310FCCD,45B
60072 :15EE11CDEE06173E,3D2
60080 :20121310FCCD1FED,3DA
60088 :30F0CD50EDCD1FED,5BB
60096 :38FB3265EF3E0032,3E9
60104 :6CEF326FEF3270EF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE8020DE0E,627
60128 :091165EFCD1FEDDA,501
60136 :AAEA1312CDEBEC0D,552
60144 :20F23A69EFE68020,51A
60152 :0D214B5C3A68EF0E,36C
60160 :004709226BEF0E00,1DA
60168 :11CDEECD1FED389A,47F
60176 :12130CCDEBEC79FE,45C
60184 :1020F03A68EFCDB1,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEFBE28133E5811,326
60208 :E0EE12133E0012CD,340
60216 :D7ECCDA6ECC3AAEA,6B1
60224 :CD1FEDDAAAEA2170,518
60232 :EFBE20E121E5EE3A,524
60240 :68EF856F3E008C67,3CC
60248 :3E00BE200BCDD7EC,40F
60256 :3E2132885CC3FFEB,482
60264 :3E00326FEF3270EF,3C7
60272 :ED5B6BEF0E00CD1F,40C
60280 :EDDAAAEA3273EFCD,634
60288 :EBEC3A68EFFE0020,506
60296 :053A69EFE6803A73,432
60304 :EF12130C3A6AEFB9,3FC
60312 :20DCCD1FEDDAAAEA,5DB
60320 :216FEFBEC22DEBCD,584
60328 :1FEDDAAAEA2170EF,5A2
60336 :BEC22DEB3E6F32E2,509
60344 :EE3E6B32E3EE3E00,490
60352 :32E4EE3A885CFE21,501
60360 :2803CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A68,5C5
60376 :EF856F3E008C6736,422
60384 :0021E5EEED4B66EF,561
60392 :0C7EFE00C2BDEA23,4FC
60400 :0D20F63EFACDB4ED,589
60408 :3E01D3FEC366EACD,5E8
60416 :1FED30FBC3BDEAF3,594
60424 :0603AFD3FF10FB3E,3DB
60432 :40D3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F328F5C,385
60448 :328D5C32485C3E01,250
60456 :D3FE21915CCB9EFB,56B
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E08CD8FEC,442
60488 :CD84ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,5BF
60504 :CDA0ECCD84ECCDA6,661
60512 :EC233E0DCD8FECCD,4CF
60520 :84EC23CDA3EC3E03,498
60528 :CD8FECCD84ECC9CD,68B
60536 :A3EC3E07CD8FECCD,561
60544 :84EC23C97EFE00C8,520
60552 :CDBBED23C384ECFE,651
60560 :00C8F53E20CDBBED,520
60568 :F13DC38FECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CDBBED3EFF328C5C,574
60592 :C9F513E6F0CB1FCB,60C
60600 :1FCB1FCB1FF630FE,4CF
60608 :3AFAC6ECC6071213,498
60616 :F1E60FF630FE3AFA,606
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E20772310FC3E,339
60648 :0077C9E52170EFAE,53B
60656 :77C50E087EA7CB17,449
60664 :300D7EEE08773A6F,3C9
60672 :EFEE10326FEF3721,3D5
60680 :6FEFCB1623CB160D,358
60688 :20E2C1E1C9110501,394
60696 :216A00CDB503C93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C0
60720 :ED7BE601F602D3FE,548
60728 :AF2177EF35200237,2FC
60736 :C9CD77ED38E8C9CD,5F0
60744 :47EED8FECBC837C9,5E6
60752 :F5DBFF3A81EFFE00,5C7
60760 :28043E3618023E37,187
60768 :D3FFDB7FF1C9F53A,675
60776 :81EFFE0028043E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00DBFFE68037C8DB,592
60800 :FFE60237C8DBFFE6,626
60808 :302004DB7FA7C93A,3E0
60816 :81EFFE0020043E37,397
60824 :18023E36D3FFDB7F,452
60832 :C9CD47ED3A73EFDB,5DE
60840 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9C5D5E5F5FE,70D
60864 :7F2813CDF9EDFE0C,537
60872 :280CFE0D20053E20,28A
60880 :D73E0DD718103E20,34F
60888 :D73E08D73A885CFE,4EB
60896 :2128033E08D73E5F,2E6
60904 :D73E08D7F1E1D1C1,640
60912 :C9FE07281CFECB28,4F3
60920 :19FE0C2814FE0B28,388
60928 :10FE0D280CFE20FA,367
60936 :0FEEFE80FA11EE3E,4BA
60944 :00C93E07C9CD680D,32C
60952 :3E02CD01163E1832,1C4
60960 :895CC93E121601CD,302
60968 :1122C93E121600CD,257
60976 :1122C9C5D5E53E02,3EB
60984 :CD0116CD47EE38FB,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :3B5CCB6F280C3A08,28F
61008 :5CF5213B5CCBAEF1,4C3
61016 :A7C937C9F5111000,3DE
61024 :CD18EDF1C9444F57,4D6
61032 :4E4C4F414494E47,2B4
61040 :204D454E55003120,216
61048 :2020524543454956,276
61056 :4500352020204578,217
61064 :697420746F204261,32B
61072 :736963002020573,2DF
61080 :652053796D626F6C,393
61088 :2053686966742D02D,30B
61096 :204700746F205265,2C9
61104 :7475726E20746F20,39C
61112 :4D454E5520290045,27B
61120 :4E544552204E554D,309
61128 :4245522000000000,1C1
```

THIS PROGRAM is approximately 1,200 bytes and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape before you Run it. When the hex loader program is run the computer will give the prompt "Start address" and you should enter 60000 and press Return.

The computer will print the start address of the line followed by a colon and the C cursor, you then have to enter everything after the colon from the relevant line in figure 2 and press Enter at the end of each line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder ready to record before starting to type in the machine-code section.

The machine-code program can be loaded by entering the command
LOAD "DOWNLOAD" CODE 60000, 1200 (Enter)
and then

RANDOMIZE USR 60000

Provided that all of the machine code is correct you will now see the Download Menu with two options numbered 1 and 5. It should be noted that this software has been specifically written for the combination of the Sinclair Spectrum 48K and the OE Ltd VTX 5000 (1200 bit/s) modem. The downloading service will therefore initially only be operated at 1200 bit/s for Spectrum programs, but consideration will be given to a 300 bit/s service should the demand arise.

To receive software from Telsoft, the *Your Computer* downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone number to ring for the 1200 bit/s downloading services.

When a program you want to download is available follow the instructions under lined on page 67.

When all blocks have been loaded correctly the program will return you to the Telsoft Menu. Then select Option 5 to leave the Telsoft Menu and return to Basic and Save and Run the program as required.

The full communications package will be made available on Telsoft shortly. This is a longer machine-code program which, in its current form, uses locations 61440 through to 64767 and contains Chat, Transmit and Receive modes. It can also be used in place of this program when you are downloading future programs from *Your Computer* service using just the Receive mode, the operating instructions being the same as for this program. Note, however, that the full Telsoft package starts at location 61440, whereas the downloading section contained in this article starts at 60000.

QUALITY CONTROL FROM CREATIVE SPARKS ON C64

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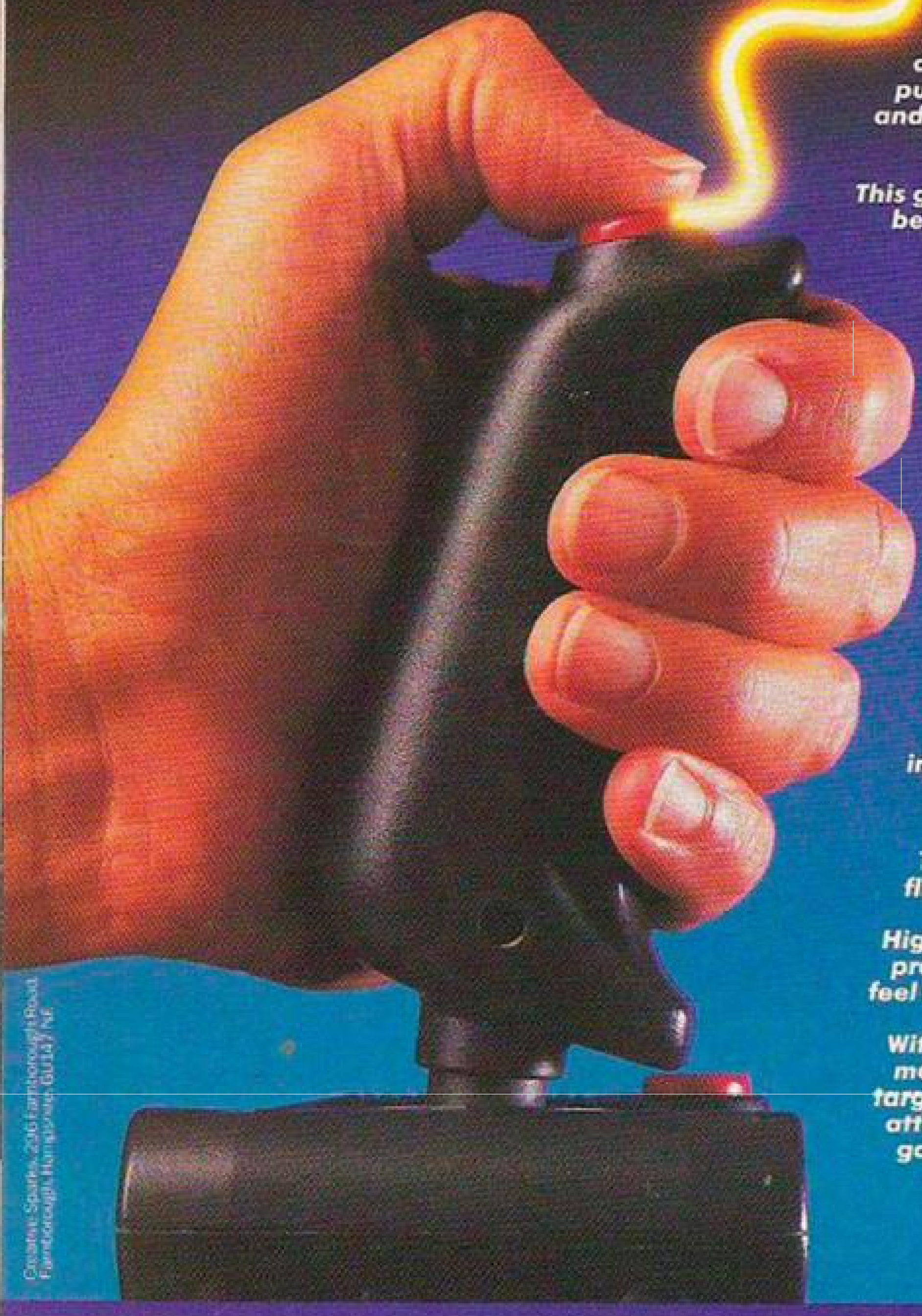
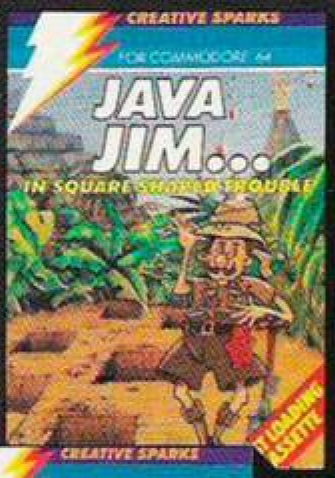


JAVA JIM

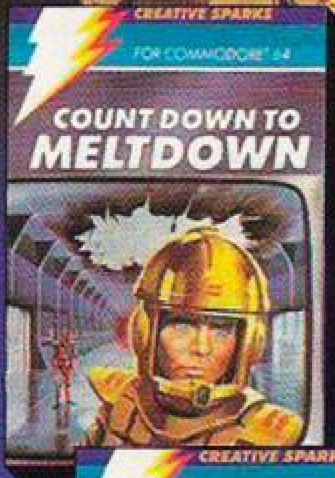
Guide Java Jim around the screen digging neat square holes as he searches for ancient relics. You will have to avoid the lumps of sizzling lava being continually showered down on Jim from the still active volcano in this highly original fun game.

4 full graphic all action screens.
20 levels of play.
High score feature.
Fast loading cassette.



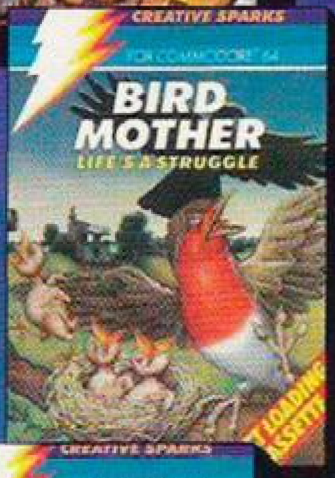
COUNTDOWN TO MELTDOWN

An amazing graphic action adventure game which puts you in charge of a team of androids trying to reach the core of a nuclear reactor before it explodes.
This game has over 2000 rooms to be negotiated and every single one of them is in 3D!!
Probably the most exciting game yet developed for the C-64.
Fast loading cassette.



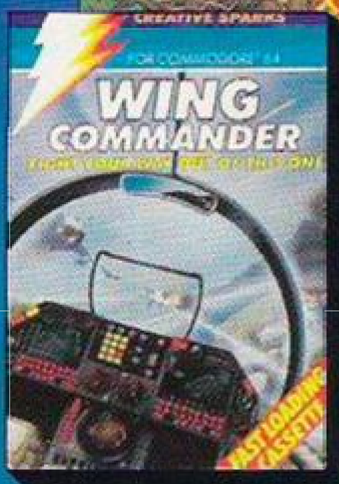
BIRD MOTHER

This is a delightfully original game which uses nature as the setting for a highly compelling and challenging game. Guide the Bird Mother as she builds her nest and raises her young, finally protecting them from a predator hawk.
Fast loading cassette.
The stunning graphics and music in Bird Mother are not to be missed.



WING COMMANDER

This is a highly sophisticated flight combat simulator which puts you in the pilots seat. Highly advanced machine code programming has ensured you feel every stomach lurching dive and roll.
With 17 separate controls to be monitored and several ground targets to be defended from the attacking enemy bombers. This game will stretch your skills to their limits.
Fast loading cassette.



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Address

YC1284

(continued from page 69)
programs contain data statements that will be used to create a machine-code routine when the program is actually run. In this case all that need be sent is the Basic program only, since this contains all the necessary information to locate the machine code accurately.

Receive mode: There are two applications for the Receive mode. The first is in conjunction with the previous section — ie: receiving blocks of data from another computer — and the second is in conjunction with the Telsoft downloading facility.

When receiving data from another computer the receive mode is selected by pressing 1 when the main menu is displayed. The screen will clear and then, as each block is received, its block number — in hex — its title and an OK will be displayed. As mentioned before, faulty blocks are automatically repeated, and thus if a very noisy line is encountered and frequent errors are occurring both computer users are aware of the problem. When all blocks have been received correctly, a "program loaded OK" message is displayed and both computers automatically revert to Chat mode.

The same receive software is used to run *Your Computer* downloading service but in this case, since the program is continually transmitted in a loop 24 hours a day, loading will start at the beginning of the next block number that the computer sees immediately following connection to the service. With a continuously transmitting service there is also no possibility of retransmitting blocks when errors are received, so some other method of error correction has to be adopted.

The method adopted to overcome this problem is as follows; when the received block number reaches the point at which the computer started to load the data, checks are made to see whether any blocks contain errors; if there are none, then the program will stop loading data and return to the main menu.

If, on the other hand, some errors have been received the program will continue to look for, and then load in again, all the individual blocks which were received with errors. Naturally, error-free blocks are not loaded again to avoid any chance of them containing errors the second time round!

Transmit mode: This is selected by pressing 2 when the Telsoft main menu is displayed. The screen will clear and you are prompted "Transmit Basic (Y/N)" to ask if you want to send a Basic program. The computer notes the answer and then asks "Transmit Bytes (Y/N)" to find out whether anything apart from Basic — for example: a machine-code section — is to be sent. If your response is "Y" the computer will then ask "How many areas (1-7)?". Once you have indicated the number of separate areas to send you will be prompted for the first and last address — in hex — for each area.

When this section is complete Telsoft will prompt you for the program title for this transmission, which may have a maximum of 16 characters in it. Transmission then begins automatically and continues until all blocks have been sent and acknowledged as being correctly received. As each block is sent the block number — in hex — is displayed, together with a + for each 16 bytes sent and a final OK when acknowledged. When all the blocks have been sent Telsoft reverts to Chat mode.

If you have received a program from another user, check whether the transmission included any machine code or data areas — apart from Basic — and, if so, make a note of the relevant addresses. Then finish the telephone call, press Ctrl — or Symbol Shift — and G to return to the Telsoft main menu and press 5 to exit to Basic. Then use the normal methods to save on tape or disc as appropriate.

Programs available on Telsoft service: At the time of writing, programs for the BBC model A and B and Spectrum 48K computers have been completed and given limited trials which were successful. A program has also been completed for the Commodore 64 computer but has not been sufficiently tested.

It should be noted that the Telsoft communication programs offered are only compatible with each other and the downloading service. For communication to bulletin boards generally a much simpler range of software is needed and on the other hand communication with Viewdata services such as Prestel requires more complex software. ■

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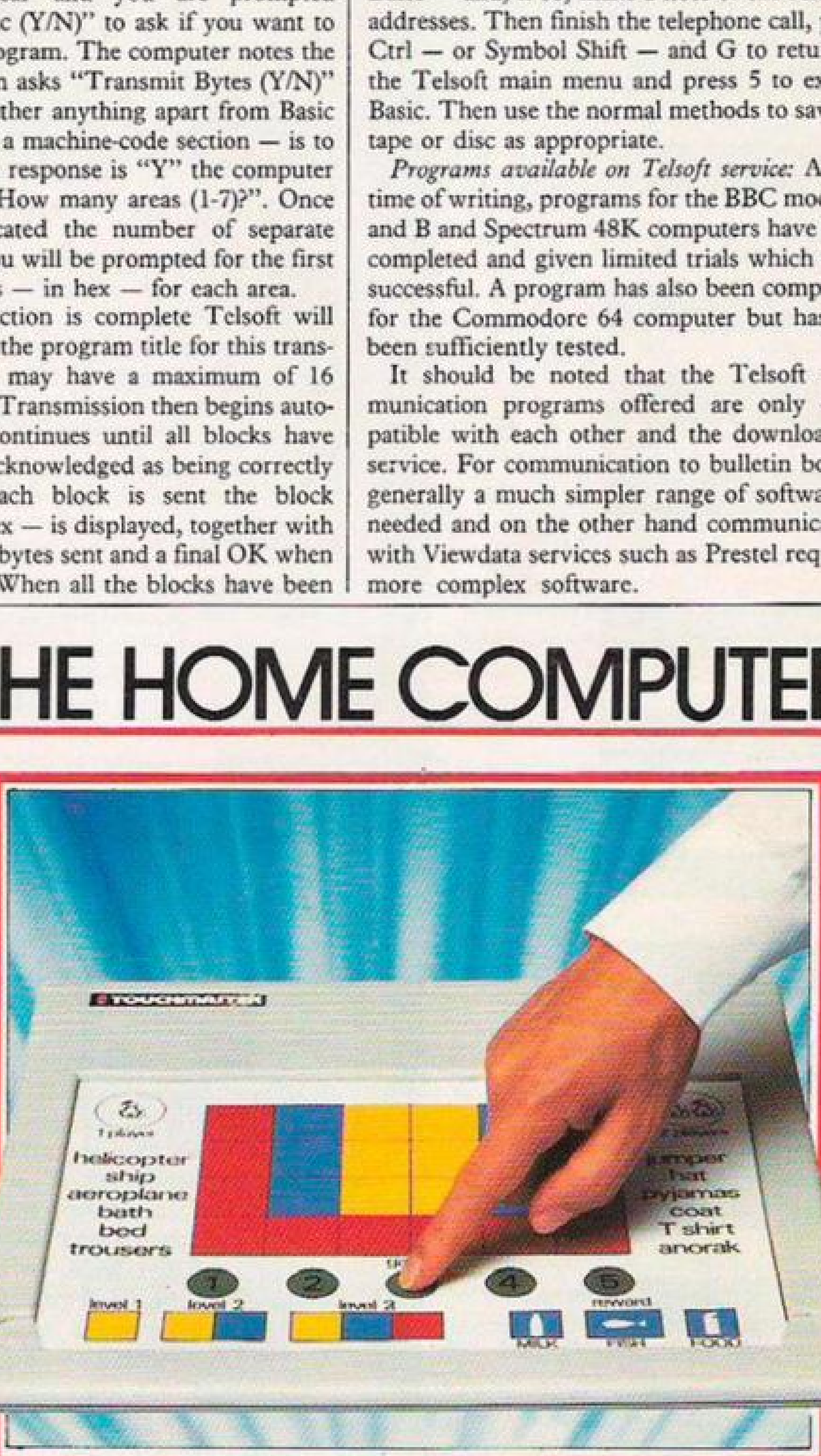
To operate Touchmaster, you simply slide an overlay onto its surface, load the matching Touchware into your computer and touch the overlay.

For repeatability and resolution, no other ostensibly comparable pads can touch Touchmaster.

In fact, Touchmaster's unique technology makes it state of the art when it comes to such pads.

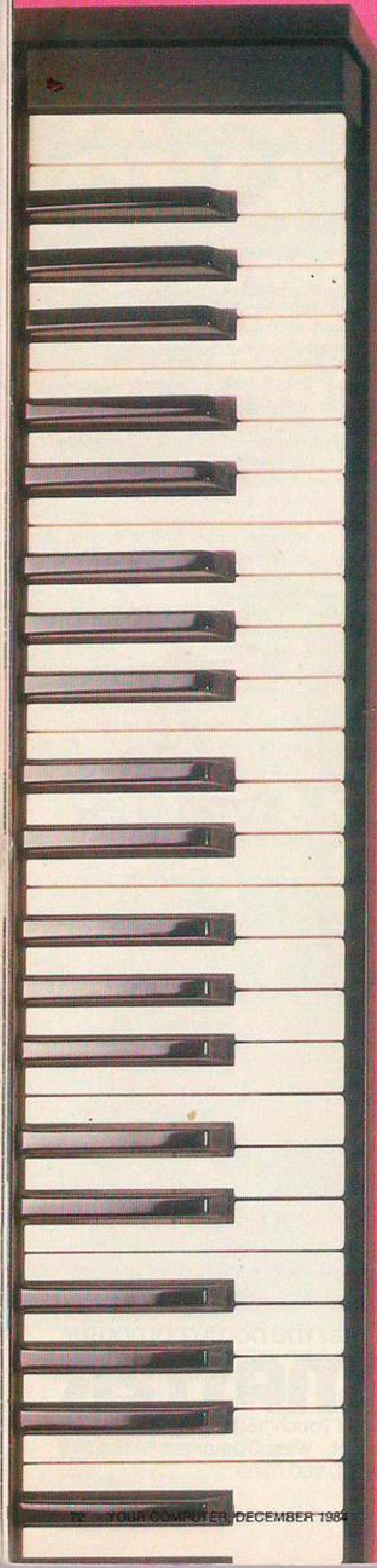
Other pads might fairly be described as peripherals. Touchmaster goes a lot further: it respecifies the home computer.



Now anyone can master the home computer

TOUCHMASTER

For full details, contact Touchmaster Limited, PO Box 3, Port Talbot, West Glamorgan SA13 1WH, or phone Teledata (01) 200 0200



REVIEW

YAMAHA CX-5M

Is it a computer or is it a synthesiser? Yamaha's CX-5M is an MSX micro with two keyboards. Tony Sacks ran his fingers over both.

1984 HAS BROUGHT the very different worlds of the micro buff and the musician considerably closer. On the micro front, there has been a noticeable increase in the amount and quality of software and hardware designed to make the most of computers' built-in sound making facilities. This is particularly true of micros like the BBC and the Commodore 64 with their relatively sophisticated music chips.

Meanwhile, musicians are beginning to exploit the tremendous possibilities offered by Midi — the Musical Instrument Digital Interface. As described previously — *Your Computer*, September 1984 — Midi is a digital Esperanto which allows various electronic instruments such as synthesisers, sequencers and drum simulators to send digital messages to each other. With suitable interfaces these instruments can also be connected to computers.

Yamaha's CX-5M merges these two worlds in one £449 machine. Superficially it looks like any of the rapidly-growing army of MSX clones. The only sign that it is something special, is the inscription "music computer" next to the model name.

A tour around the crowded perimeter of the computer begins to reveal its dual personality. In addition to the standard MSX sockets for joysticks, Centronics printer and TV and monitor outputs, there is a pair of DIN sockets marked Midi In and Out, two additional stereo sound outputs and a Music Keyboard socket. In all, the machine has more than 180 electrical contacts waiting to communicate with the outside world.

The CX-5M has a professional look and feel emphasised by a sober grey and black colour scheme. The keyboard is pleasant to use, despite a slight wobble on the space-bar. The only oddity is the inclusion of a blank "dead" key used to add various accents to vowels for foreign languages. There is no £ key although the sterling symbol can be accessed from the vast MSX character set using the Code and Shift keys.

Two switches — one on the computer, the other on the substantial power supply — are needed to turn the CX-5M on. If the Rom cartridge slot is unoccupied the machine tells you that it has 28,815 bytes available from its 32K of RAM. In this mode the computer does everything that you would expect of an MSX machine.

However, type in the command of Call Music and you enter a different world. You now have access to the computer's unique feature — a built-in FM sound synthesiser.

Two music keyboards are available to plug into the socket mentioned above: a miniature 44-note device costing £85; and a full-size 49-note keyboard costing £165. In the MSX Basic mode, these keyboards are lifeless, but once you enter the synthesiser mode, you can use either keyboard to play any pair of sounds from the CX-5's repertoire of 46 pre-defined sounds or "voices".

The keyboard can be "split" at any note along its length so that two different voices can be played on different halves of the keyboard at the same time.

The quality of these sounds is one of the

FM — a natural way to synthesise

The synthesiser in the CX-5M is not an ordinary synthesiser — it's an FM synthesiser.

It uses a different approach to sound synthesis to that used in almost all other synthesisers, including those built into the BBC and Commodore 64 micros.

Most synthesisers are based on a technique known as subtractive synthesis. Simple, but harmonically rich, waveforms such as square waves or sawtooth waves are progressively filtered — to remove or emphasise certain frequencies, modulated, and manipulated in other ways to produce the final sound.

This technique can result in powerful sounds but they invariably have an artificial feel to them. This is because the relative strengths of the various harmonic components remain fixed for the length of each note. In acoustic instruments, this balance changes constantly.

FM synthesis is designed to produce more natural sounds by simulating this process. It does this using a technique

CX-5M's main strengths. They range from powerful simulations of real instruments such as pianos, flutes, guitars and organs to gimmicky sounds such as the "chirping of a small bird" and the "sound of raindrops". At their best — in, for example, the harp and timpani simulations — the sounds are stunning, and even the less convincing voices are not unpleasant.

The quality of the sounds is one immediate difference between the CX-5M and other micros. Another difference is that the Yamaha computer can produce up to eight notes simultaneously, compared to the three of the Commodore 64 or the BBC.

A third difference is the inclusion in the CX-5M of an automatic rhythm section to accompany you while you tinkle away on the ivories. You can select a variety of drum, bass and chord accompaniments to join you as you play. It must be said, however, that the sounds and patterns of this accompaniment are disappointing compared both to the quality of the main synthesiser voices and to rhythm sections in all but the cheapest portable music keyboards.

If you want to store your musical efforts, there is a Record facility which will remember up to 2,000 notes as you play them. You can then play back the recorded section and accompany yourself on the keyboard at the same time. If you are pleased with the result you can dump it onto a cassette.

Although you can tinker slightly with the 46 standard voices using the firmware, you cannot alter the basic sounds. To make fundamental changes to the voices or to create your own new ones, requires additional software.

Fortunately, Yamaha has produced a Rom cartridge containing this software. Each FM voice is defined by more than 60 inter-related parameters and altering these to achieve a specific effect is not easy. Creating a new voice from scratch is even harder. The FM voicing program is designed to make this task as easy as possible and, in general, it succeeds.

However, considerable practice is needed before you get a feel for how altering any particular parameter will affect the overall sound. The 48-page manual that accompanies the voicing program gives some guidance on how FM synthesis works as well as some examples of how to create new voices.

The FM Voicing Rom is one of four software ROMs, each costing £36, that Yamaha has developed to tie in with the launch of the CX-5M. Perhaps the most interesting of these from the micro enthusiast's point of view is the FM Music.

Macro Rom which extends the MSX Basic with 36 new commands that allow the synthesiser to be controlled from Basic.

The Music Macro permits the playback of eight musical parts using up to four different voices while a Basic program is running. These voices can come either from the standard 46 sounds or from a data cartridge holding new voices produced by the voicing program.

Using the Music Macro cuts the memory available for Basic programs to less than 20K. The number of notes per part is limited to a maximum of around 500 although parts can be chained together if necessary.

The Music Macro can be used to control other electronic musical instruments including synthesisers and synthetic percussion devices through the Midi link. It also allows the programmer to define patterns for the built-in rhythm section.

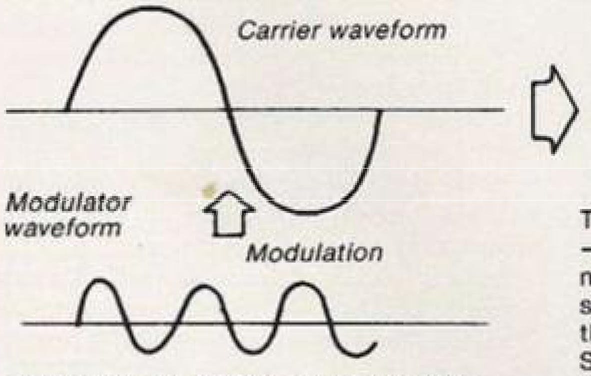
The third Rom will probably help to sell the CX-5 more than any of its other attractions. It contains a composer program which allows a musician to write a six-part musical score on the computer screen using conventional musical notation and then to play the music back through the internal synthesiser, or through external instruments via the Midi link, or both.

The notes are entered using either the musical or computer keyboards. In the former case, the notes can be played at any speed — the computer only accepts the pitch information, not the timing.

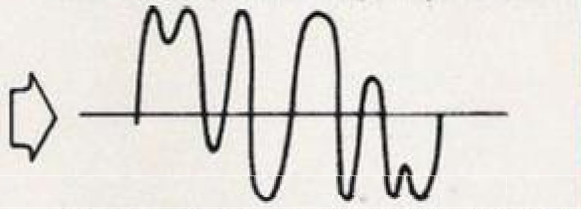
A particularly attractive aspect of the

(continued on next page)

Changes in the waveform caused by FM



When the waveform is frequency modulated



similar to that which produces FM — frequency modulation — radio transmissions. Essentially, one simple waveform — the carrier — is modulated by another — the modulator — to produce the natural-sounding output.

This simple idea proved difficult to put into practice. It took Yamaha more than a dozen years to perfect and to squeeze the complex digital circuitry on to LSI chips.

Last year, Yamaha launched the first FM synthesisers that musicians could program to produce their own sounds. These synthesisers — the DX-7 and DX-9 — took the music world by storm and now almost every band that uses synthesisers has at least one DX machine. On their recent megatour of the United States, the Jacksons used at least 10 of the £1,300 DX-7s on stage.

The synthesiser in the CX-5M is a slimmed down and modified version of the £900 DX-9.

One of the snags of FM synthesis is that it is more difficult to program new sounds, especially for synthesists used to traditional synthesisers. The Rom cartridge supplied with the CX-5M is designed to make programming of its built-in sounds easier. One of the other Rom cartridges does the same job for the DX-7 using a Midi link between the computer and the synthesiser.

(continued from previous page)

composer program is that it allows conventional musical symbols and expressions for dynamic changes in a composition to be entered along with the notes. These musical instructions are followed by the synthesiser when it regurgitates the music, giving the sounds an eerie, almost human feel.

The program is not, however, perfect. Most of the CX-5M keys are redefined to allow the musical notation to be entered and because the program operates in two different modes, many of the keys have two functions. This can cause confusion as you swop between the two modes. A keyboard overlay or on-screen indication of the redefined keys would ease the confusion, but neither is provided.

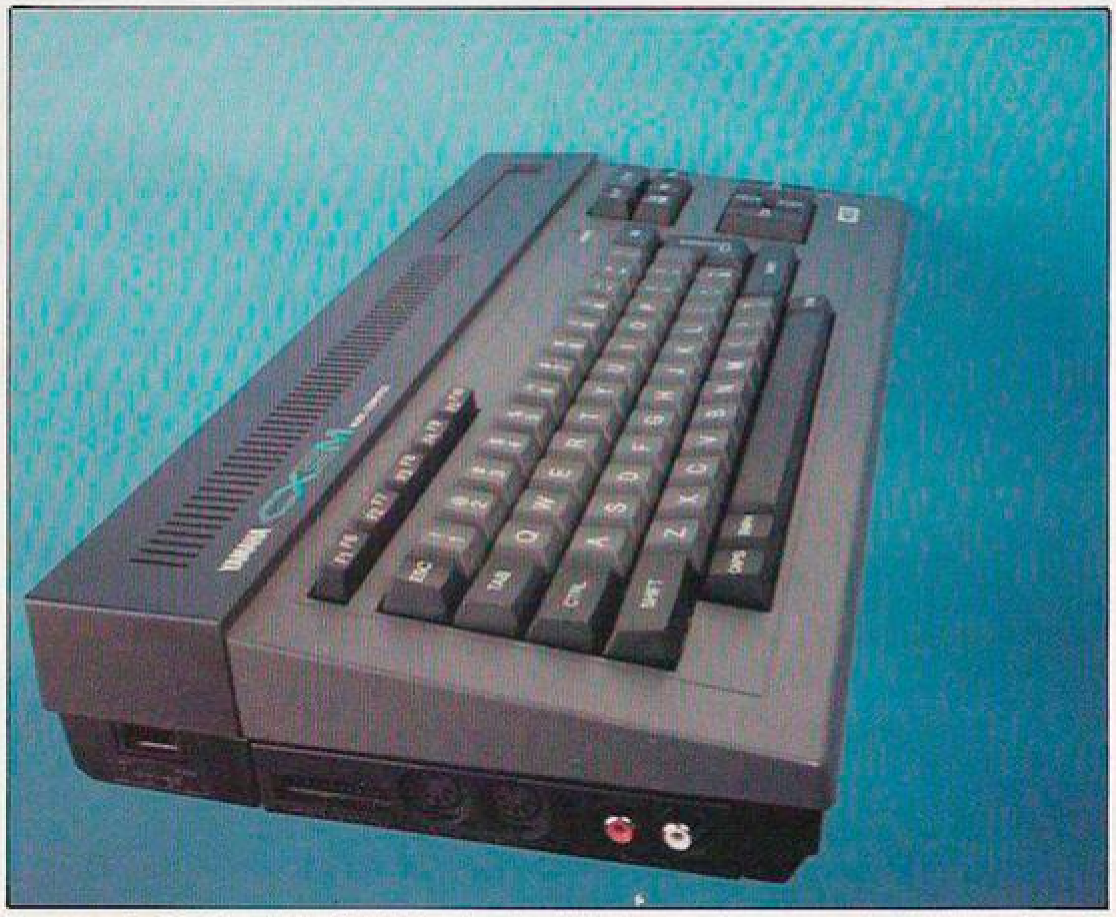
Pixel resolution problems

Other problems arise from the 256 by 192 pixel resolution of the CX-5M's display. This means that only one of the six parts can be shown at any one time and it can become complicated working out how the various parts tie in with each other. The one-part-at-a-time limitation also applies to printouts.

The limited screen resolution also means that it can be difficult to distinguish between similar note symbols. And chords have to be displayed confusingly as emaciated notes spread across the stave.

But the many attractions of this program far outweigh these minor difficulties which do not affect the quality of the music it can produce. Regular users of the package will probably soon adapt to its idiosyncrasies.

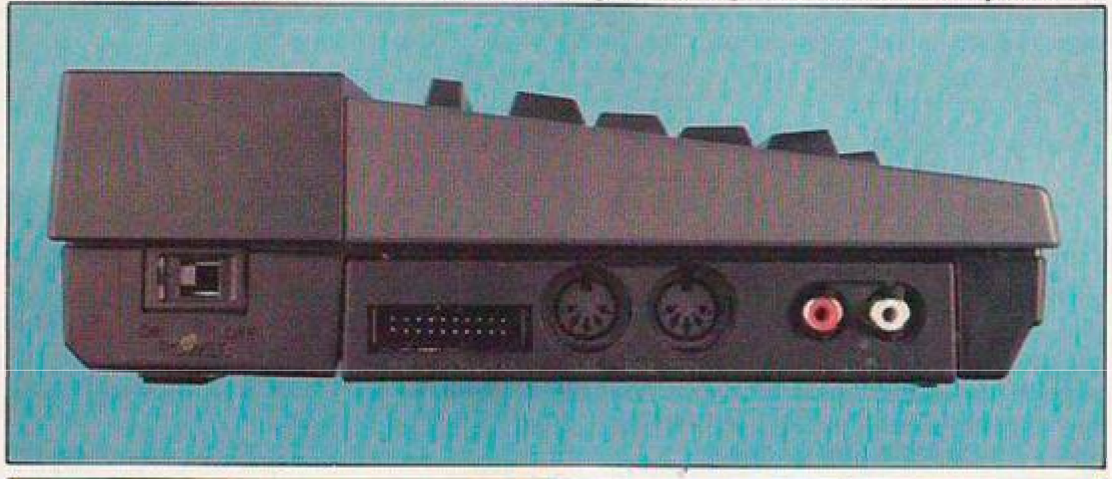
The final Rom cartridge will only be of interest to owners of Yamaha's DX-7 synthesiser. This instrument can produce even more impressive sounds than the CX-5M but is correspondingly more difficult to program. The cartridge is designed to ease the task by displaying the parameters graphically on the CX-5M screen where they can be edited. Information is exchanged between the DX-7 and the CX-5M using the Midi link.



So there we have it. The CX-5M is certainly a computer with a difference. On the whole it is a well thought out machine with a few minor disappointments.

One of these is that the Midi interface built into the CX-5M does not offer full two-way Midi facilities. While it can transmit signals to control external synthesisers, it cannot itself be controlled by other synthesisers.

The lack of a full Midi interface also means that musicians will not be able to use their own Midi instruments to provide a musical input for the CX-5M. Most will probably regard the optional miniature keyboard as little more than a toy and will have to buy the larger £165 keyboard to make best use of the computer. A full Midi interface could avoid this extra cost.



Despite this, it is easy to see why the machine will appeal to musicians and why there have been waiting lists for it since it made its debut at a music industry exhibition earlier this year. Musicians are used to spending upwards of £600 for a synthesiser, so to get a computer and a Midi interface thrown in at the same price must be a bargain.

Ironically, the price is also likely to be the main barrier to the machine appealing to a wider audience. You have to be either wealthy or keen on music — or both — to pay more than twice as much for the CX-5M and keyboard as you would for an ordinary MSX machine of a similar specification.

Yamaha planning software

Another factor likely to deter many would-be purchasers is that there is unlikely to be much independent software that takes full advantage of the computer's facilities. Companies which do produce software will probably aim their packages at the musician and will charge high prices to cover the limited market for their products.

Yamaha itself is planning further software packages but has not revealed any details. There are, however, several types of program that could widen the appeal of the CX-5M, the most important of these being for education. The CX-5M could provide an excellent tool for teaching music, using on-screen displays and prompts. But this will not happen until the right software becomes available.

On a final, more optimistic note, the prices quoted in this review may be short-lived. The music industry is notorious for substantial retail discounting. As the CX-5M is being distributed mainly through the music trade, the cost-cutting practices may well be applied to it within a few months. ■

CONCLUSIONS

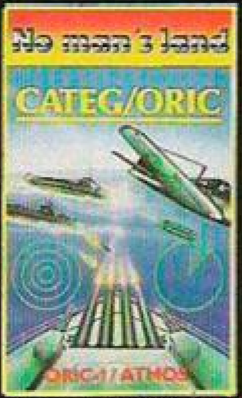
- The CX-5M is the most interesting and original of the MSX mutants to reach the U.K. so far. It is a well designed and well constructed machine.
- The quality of the sounds produced by the CX-5M show the painful limitations of the sound-making capabilities of even the best of other micros.
- At a cost of more than £600 for the computer and the full-size keyboard and £36 for each software package, the CX-5M will appeal mainly to dedicated musicians.
- It seems penny-pinching to provide only 32K or Ram when MSX machines costing well under £300 offer 64K. It will be particularly frustrating to run out of memory as you near the end of your magnum opus.
- The CX-5M proves conclusively that micros can be used for more creative purposes than merely zapping aliens, eliminating galaxies, killing dwarves and perfecting take-off and landing procedures.
- The CX-5M will probably be the first microcomputer to star on Top of the Pops.

No man's land

ORIC/ATMOS

ORIC/ATMOS

OTHER TITLES FOR CBM64/V20 SPECTRUM ZX81 AVAILABLE ON REQUEST



0503 CATEG-ORIC (action game). Take command of a cruiser engaged in battle against fighter planes and submarines. Use the radar and sonar systems to detect and destroy the enemy before you are sunk. £ 7.95

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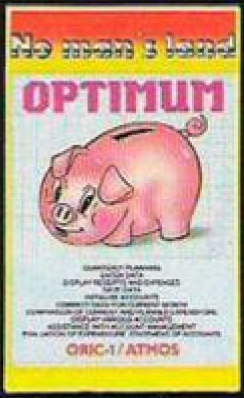

0496 OPTIMUM (home). Manage up to 4 different accounts, keep track of expenditure and compare with your monthly or yearly budget. Just what you need to keep the household accounts in order. £ 9.95

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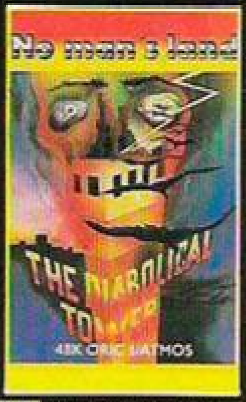

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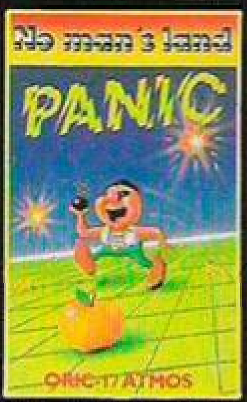
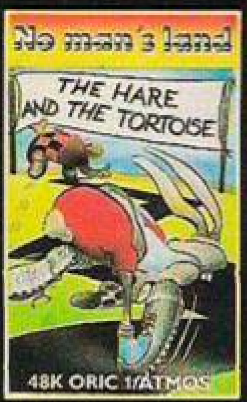


0463 PANIC (action). Catch the marauding apples by setting traps. 6 levels. £ 6.95



0515 THE HARE AND THE TORTOISE (education). A game for 3-8 year olds to teach the notions of right, left, up, down and counting. The hare and the tortoise decide to race. Who will win? The level of difficulty is adjustable to the child's ability. £ 8.50

HARD communication

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0465 CONCOURS HIPPIQUE	£ 5.95
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0507 INVOICING	£ 14.95
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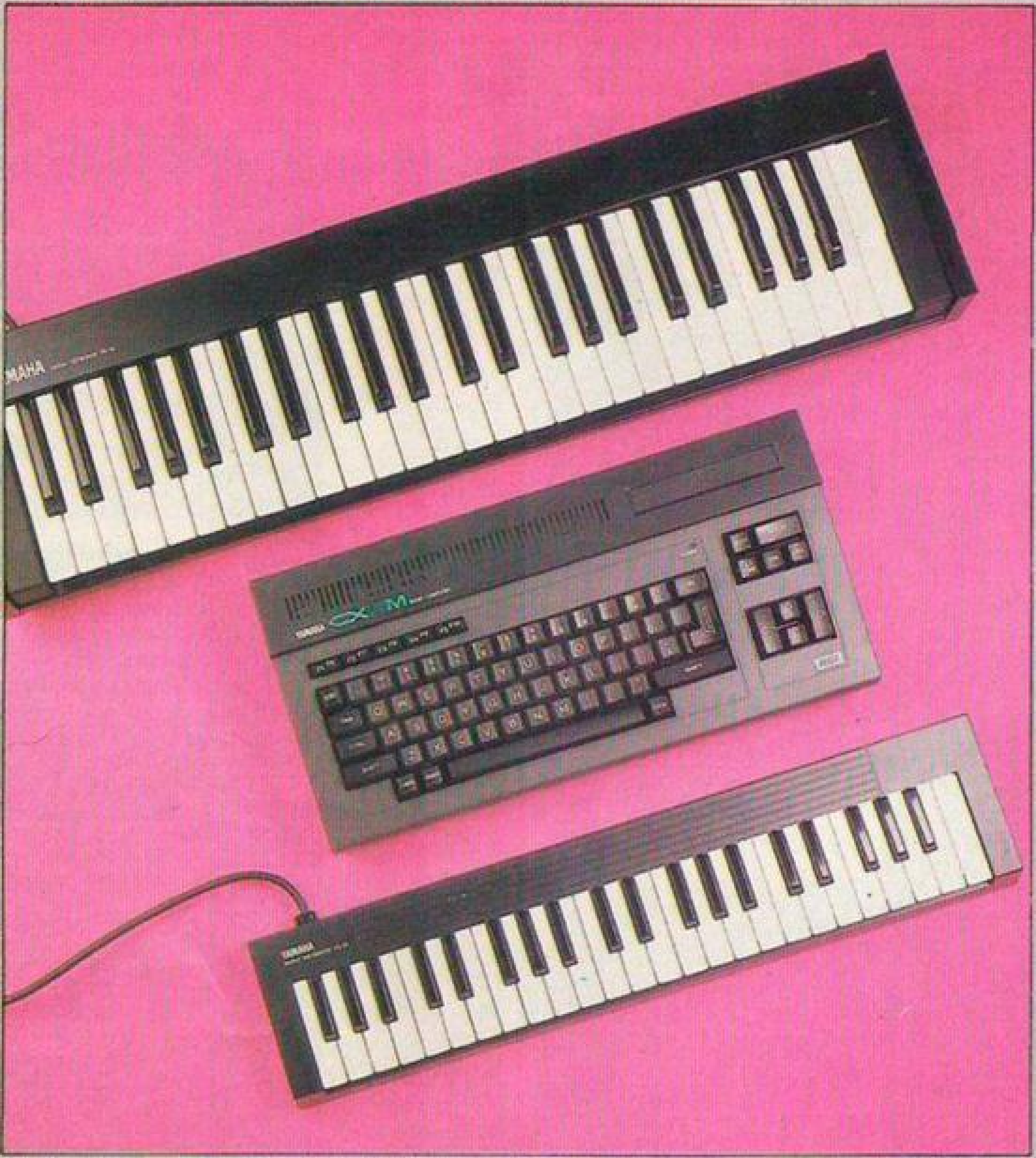
WIN

The exciting Yamaha CX-5M — piano keyboard, synthesiser, and MSX computer all in one.



He's carrying off dozens of great Christmas prizes.

This man be stopp

RULES

- The winners of the competition will be the people who correctly identify the men behind the quotes, and in the view of the Editor, come up with the most amusing quotation and attribution
- The name of the winner will be printed in the February issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in December 1984.
- Each person may enter, the competition only once.
- Entries to the competition cannot be acknowledged.
- No employee of Business Pres International or their relatives may enter the competition.
- The decision of the Editor is final.
- No correspondence on the result of the competition will be entered into.
- Business Press International assumes no responsibility or liability for any complaints arising from this competition.

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PLUS

Some of the best software yet seen on a home micro: five copies of Melbourne House's Sherlock Holmes and five chances to win Acornsoft's space romp Elite. Plus five YC subscriptions and five binders.

COMPETITION of the year

A modem — OEL's Telmod 2 and VTX-5000 for the BBC and Spectrum, and Commodore's Communication Modem for the 64.

COMPETITION OF THE YEAR

All the quotations below on the left have appeared at one time in the pages of *Your Computer*. All you have to do is match them up correctly with the personalities below right who said them. Enter the number of the personality in the box beside the quotation you think belongs to him. Then we want you to come up with a witty quotation and tell us who you think should have said it.

☐ "There's nothing in this movie that isn't happening in the world today"

☐ "We program them so that if they make a claim, the machine explodes and blows them to bits"

☐ "I will be prepared to sit down and eat one in Trafalgar Square if it's late"

☐ "Business is war"

☐ "You get these quantum leaps in electronics — we will leapfrog Clive Sinclair with technology"

☐ "Those who operate at the cutting edge of technology shall be sacrified upon it"

☐ "I've been making jokes about computers for long enough — it's about time I found out a bit more about them"

☐ "The same technology which brings us the likes of Pac-Man is scaring the hell out of our enemies"

☐ "Most home computers are current buns: printed circuit board sandwiched between two sheets of cream plastic, with a few keys sticking out of the top"

☐ "Most people are so pleased when they do manage to copy our programs that they write and tell us. We just warn them not to sell it"

1. Douglas Adams, author of *The Hitch-hiker's Guide to the Galaxy*.
2. Hermann Hauser, Acorn's technical director.
3. Geoff Hollington, designer of the Enterprise's external casing.
4. Adam Osborne, founder of the Osborne Corporation.
5. William Poel, Amstrad's software division general manager.
6. Mike Radford, director of the film *1984*.
7. Sir Clive Sinclair, Chairman of Sinclair Research.
8. Jack Tramiel, formerly of Commodore, now Atari.
9. Richard Turner, Artic director.
10. U.S. Commissioner of Customs.

What would your quotation be? ____________________

____

____

Who would have said it? ____________________

Name ____________________

Address ____________________

____

Which computer do you use? ____________________

ADD ONS ADD ONS

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The Fuller FDS. Now better than ever! All the features you'll ever need from a Spectrum keyboard all in one smart, durable unit. Space bar, cursor control keys, single key delete, caps shift, symbol shift, F1 mode, separate full stop and comma keys, beautifully made, handsome to look at and a delight to use. **£49.95** plus £2.00 p.p.

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(PLEASE STATE WHICH)

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THE VIXEN SWITCHABLE RAM £34.95

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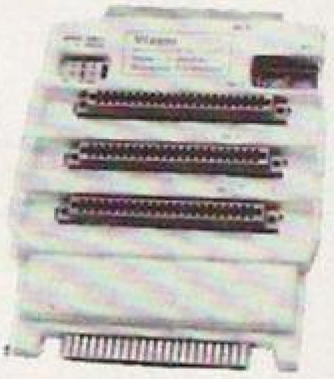

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COMMODORE PLUS 4 *competition* RESULTS

OCTOBER'S COMPETITION offered as a prize Commodore's rival to the QL, the new Plus 4. On the entry form we asked you to place eight features in order of importance. You then had to suggest names for both a program that you would like to see on the Plus 4, and the software house that would launch it.

With its built-in software the Plus 4 is clearly intended to be used more for serious applications than games playing. So in picking a winner we favoured those suggestions that reflected the machine's practical nature.

We awarded the prize to Dr W Davidson, Brunswick Health Centre, Hartfield Close, Manchester, whose list of features was the following:

1. Value for money
2. Professional keyboard
3. Database
4. Graph display
5. Wordprocessor
6. Spreadsheet
7. 60K user Ram
8. Neat wedge styling

The seventh feature, 60K user Ram, took a higher place in our panel's list. But we were impressed by the winner's program suggestion. Wittily entitled "What Brings You Here" the program would take a GP patient's case history using graphics to pin-point the site of pain, etc.

The idea has already been implemented on larger systems but there is no reason why it should not also be feasible on the Plus 4. Whether patients would — or should — be satisfield with the computer's bedside manner is another matter.

If the competition entries are anything to go by home computer owners are preoccupied with health and fitness. We were surprised by the number of people who would like to see programs for home diagnostics, diet planning, calorie counting, and the like. Software companies take note.

Some of the other practical suggestions were, perhaps, less feasible. The most common was for a program to convert CBM-64 Basic to Plus 4 Basic — a difficult feat since it would involve converting Pokes into graphics commands.

N Smith's Decompiler, on the other hand, probably could be implemented. But what would be the point of a program to translate machine code into Basic?

Ideas for games ranged from the boring to the whacky and bizarre. From J Tant came Flea Destroyer: you start off with "an overall plan of a cat, destroy the fleas with a spray can, then move on to a dog".

We were tickled by J Kingsbury's Highland Fling, a Scottish version of Decathlon, in which you participate in events like tossing the caber. Also noteworthy was D Ahearn's game for paranoiacs, Stop your Neighbours. The idea here is to prevent your neighbours from encroaching on your property.

In B Gadd's Deadline you would have to produce a monthly computer magazine, collecting features, artwork, letters, and so on, while overcoming such obstacles as strikes, gremlins, ghostly news-hounds, and paper shortage. Sound familar, but not much fun to play. ■

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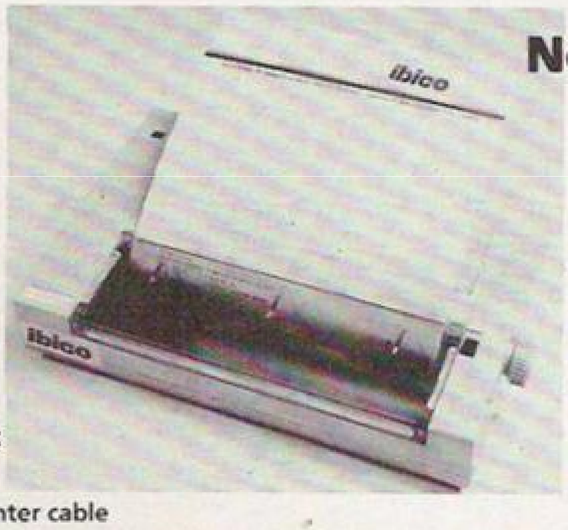

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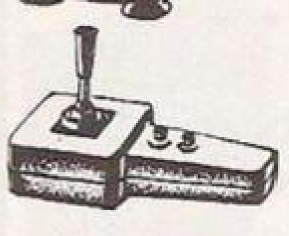

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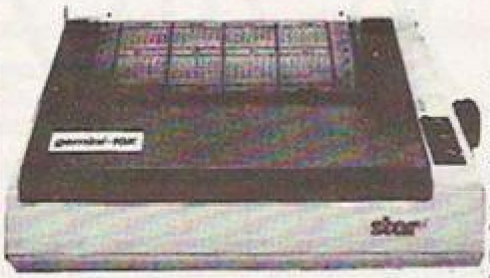

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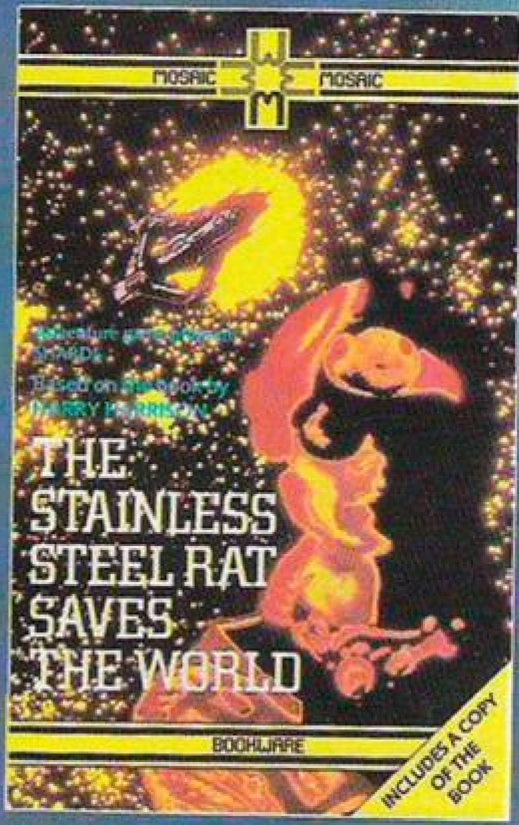

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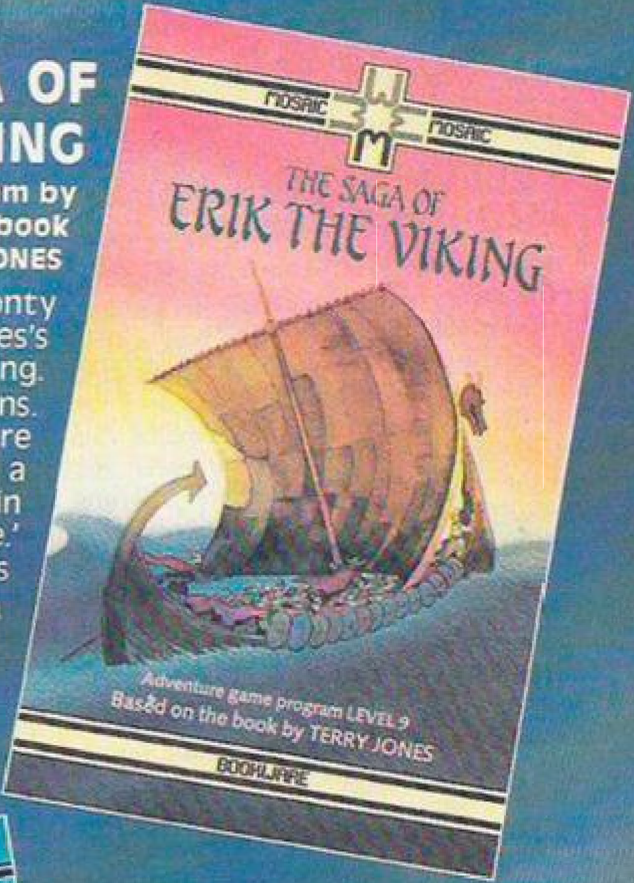

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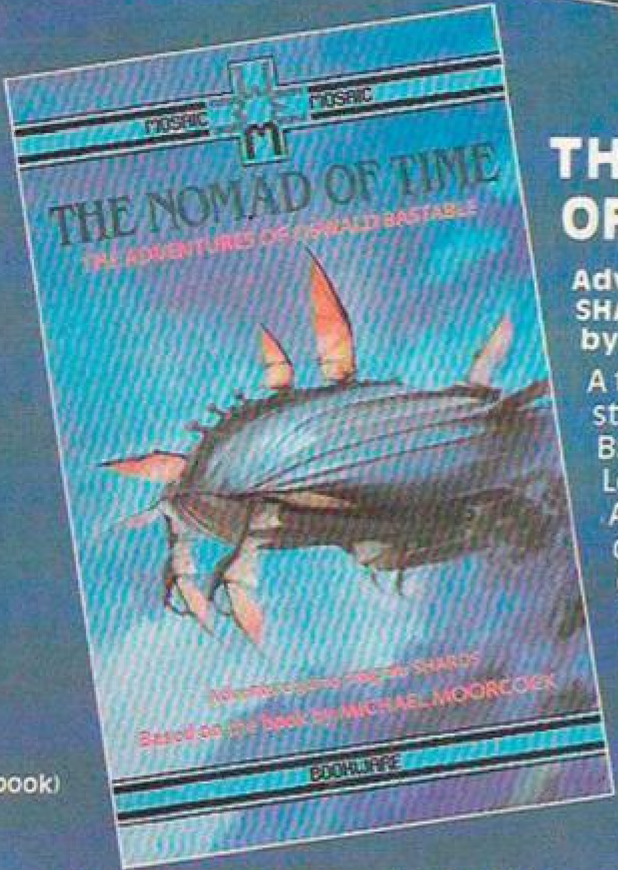

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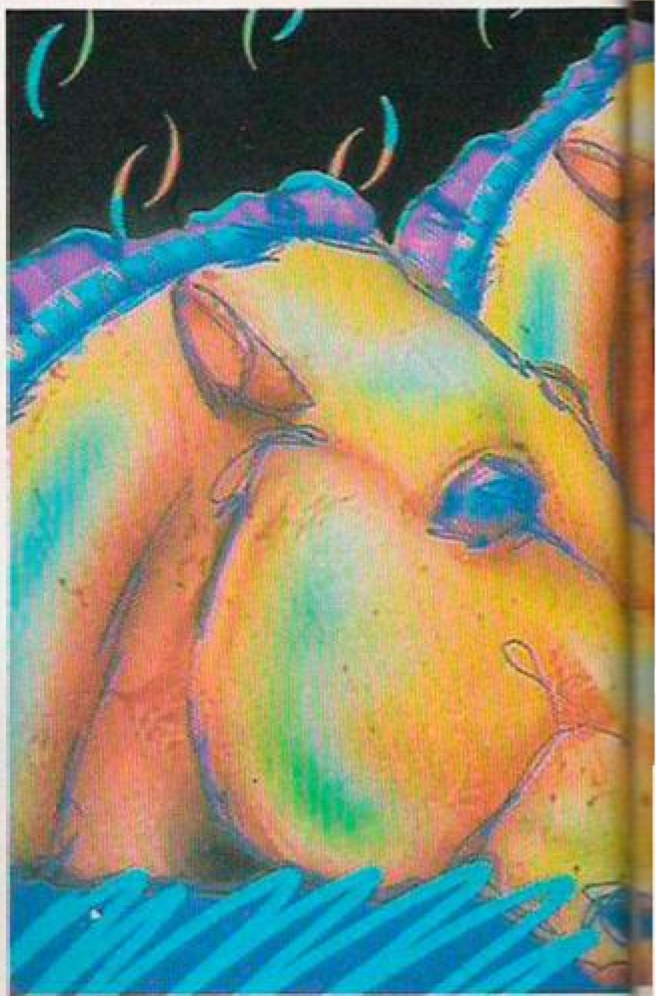
FROM HERE TO REALITY

Today's home computer cave paintings are only 16 million colours away from reality, says screen star Simon Beesley...



ANYONE WHO HAS seen *Tron* will be impressed by the quality of the film's computer graphics. But believable though they are they still fall short of the goal of computer animation which is to simulate reality on screen.

At the London Computer Graphics Conference held recently, Loren Carpenter, staff scientist at Lucasfilm's Computer Division, discussed the exciting possibilities of a computer graphics future in which you will be able to turn your imaginary landscapes into screen reality: "Artists will be able to see their creations move. Filmmakers will feel free to experiment."

But for the moment such scenarios remain the stuff of science fiction. Lucasfilm, for example, is developing what might be described as the next generation of graphics machines, the Pixar 2D and 3D systems. Although more advanced than any current system the Pixar 3D will still take up to two minutes to generate a single realistic movie frame.

Consider the problems involved in creating a convincing 3D perspective image. First you need to define the objects to be displayed in terms of their x, y and z (depth) co-ordinates. As a high-resolution film image may contain many thousands of objects, this process, known as 3D or solid modelling, is extremely time-consuming. One technique is to build up complex objects from 3D "primitives" — polygons such as cubes, spheres, cylinders, pyramids and so on.

To describe a single object such as an aeroplane in this way could mean combining hundreds of different polygons. On flight simulators it typically takes at least a week to model a new plane.

Creating images of irregular objects with sculptured surfaces is even more difficult. In 2D you can trace an outline of a shape simply enough using a digitising tablet. But there is no equivalent device for entering 3D dimensions as easily.

Recently a computer graphics company wanted to show a perspective image of Rodin's sculpture, the Thinker. To enter it into the computer the programmers had to resort to making a physical model of the sculpture, and slicing it up for measurement.

The ideal solution to these problems has already been postulated by computer graphics experts — a sculpting system. Like a 2D painting program it would allow you to create free-form designs but in 3D. With an electronic "chisel" you would be able to chip away at the image of a block of marble or mould a pixel-based lump of clay.

When it comes to modelling natural phenomena such as leaves or mountains rather than describe the objects you may need instead to supply a procedure or algorithm for generating their images.

Fractal features

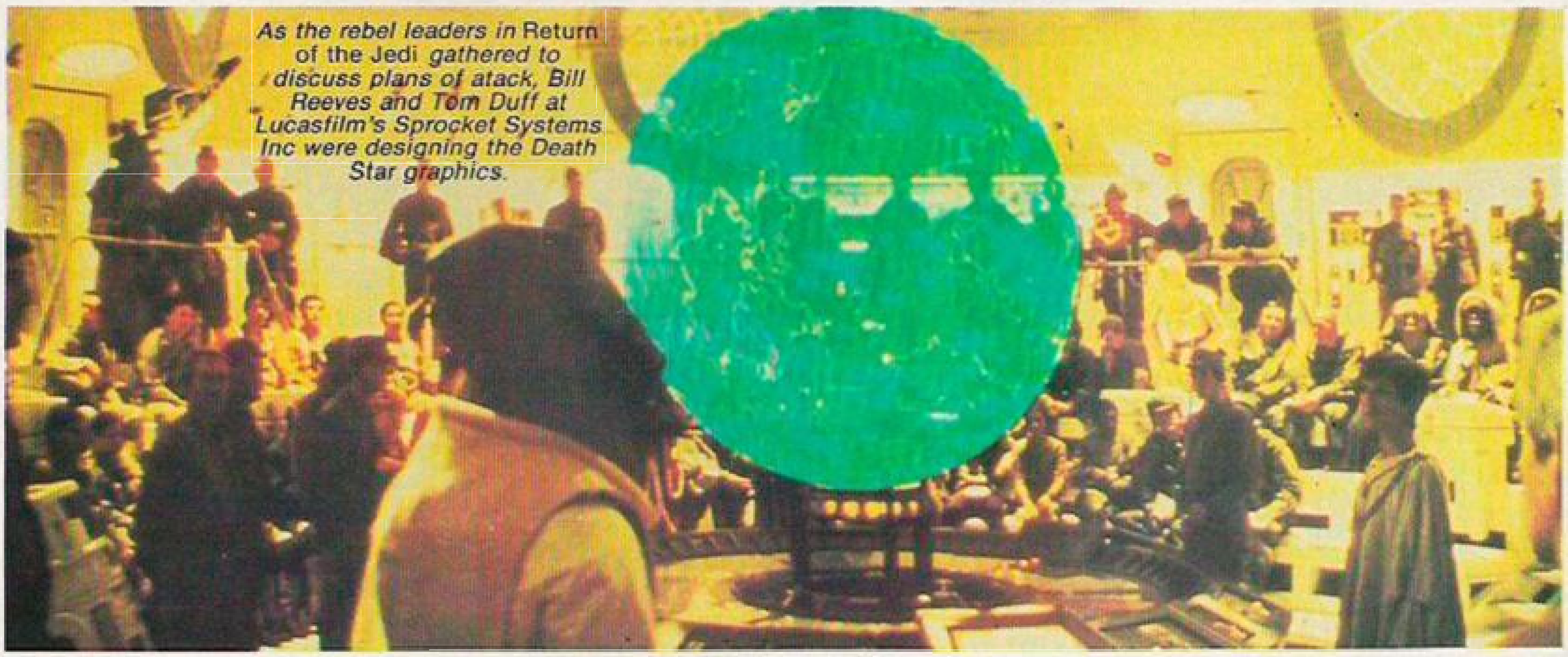
One such procedure exists for creating irregular and crinkly lines. Known as "fractals" they have been used for some highly realistic displays of mountain displays.

In Return to Fractalus, a computer game designed by Lucasfilm for Atari, fractals are employed to construct a constantly changing landscape. Apart from spaceships and gunposts none of the game's images are stored.

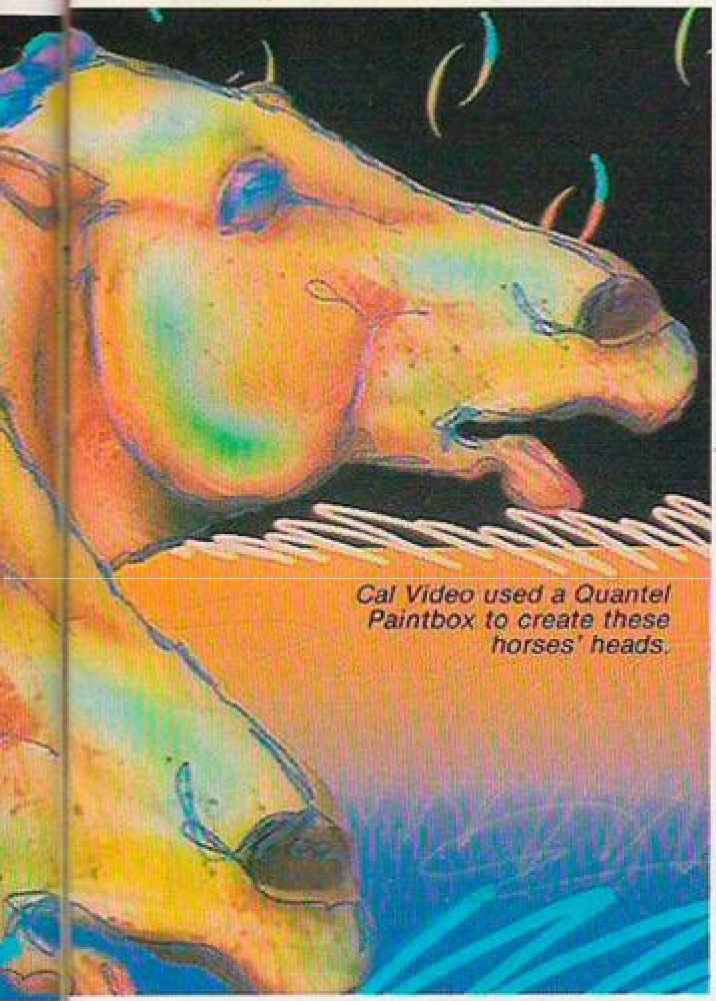
Once you have modelled your 3D objects there are numerous steps yet to be taken before they can be displayed as convincing perspective images. For a start you need to calculate which co-ordinates lie within the limits of the display; those outside need to be removed by a clipping procedure. Since the 3D images are to be displayed on a 2D screen the co-ordinates must then be converted to give a perspective view.

At this stage objects can be shown as wireframe figures. To give the impression of solidity it is now necessary to work out which lines and surfaces will be visible.

Again, this process — hidden line removal — is a lengthy one. In his book *Advanced Graphics with the BBC Micro* IO Angell suggests that implementing hidden-line removal algorithms is almost beyond the limits of a home micro's processing power. He supplies a



As the rebel leaders in Return of the Jedi *gathered to discuss plans of atack, Bill Reeves and Tom Duff at Lucasfilm's Sprocket Systems Inc were designing the Death Star graphics.*



Cal Video used a Quantel Paintbox to create these horses' heads.

routine written in BBC Basic. It takes 15 minutes to calculate the visible surfaces of a single cube frame figure. By contrast a realistic film display may be broken down into more than a million polygons, all of which must be tested for visibility.

The final stages in computing a 3D image deal with simulating texture, shading and shadows. Providing these effects is an extremely complex business. Among other things it must take into account such features as different light sources, the reflective properties of different surfaces, and the properties of translucent materials like glass.

Smoothing the jaggies

A further problem with forming realistic images is that at all but the highest resolutions raster displays show diagonal lines as jagged — an effect known as "aliasing". One solution is to increase the pixel density. Apple's Macintosh gives an excellent picture by using a density of 80 pixels per inch.

Another solution, which is widely used, is to alter the colour intensities of pixels at the edge of lines. This technique, called anti-aliasing, smooths out the "jaggies" at the cost of giving lines a slightly blurred look.

The term "raster" refers to pixel-based displays — as found on all home computers — in contrast to vector displays whose images are made up of straight lines. Advanced raster displays use frame buffers to store the colour information for each pixel. In this respect a frame buffer is simply a grander version of the home computer's screen memory.

Naturally generating realistic computer graphics calls for higher pixel resolutions than are found on home or personal computers. If the graphics are to be recorded on video tape then the resolution does not need to be higher than that of a TV display, roughly 600 lines with 700 pixels across. But for the film the resolution must be mugh higher — sometimes as much as 4096 by 4096.

As the highest resolution currently available on raster monitors is not much more than 1600 by 1200 only a portion of the picture can be viewed at a time. Recording to film involves writing the image directly from the frame buffer to celluloid.

The most advanced raster graphics systems provide for up to 16 million colours at once. This means that each pixel requires 24 bits to hold its colour code. Consequently, storing these images requires enormous amounts of memory, running into megabytes of Ram.

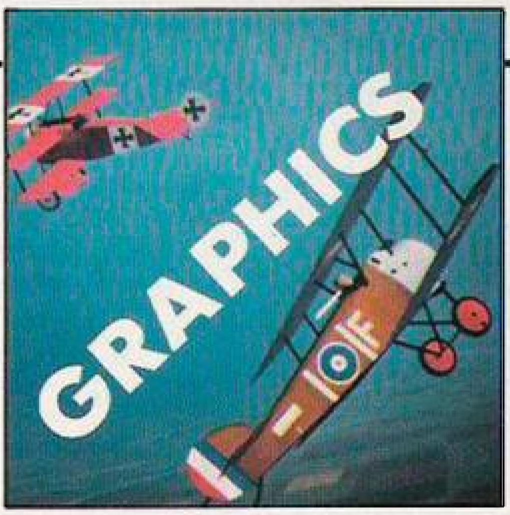
With pixel arrays of this size the number of computations necessary to build up a 3D image is staggeringly large. Many of the frames for the animation in the film *Tron* took over 15 minutes to compute. Even using supercomputers such as the Cray XMP, computer animation companies may take days to produce a minute of film. For complex scenes real-time animation is a long way off.

In the world of computer graphics real-time can mean any speed from 10 frames per second to the rate at which television images are transmitted. 25 fps.

Where less complex scenes are concerned some computers are certainly capable of real-time animation. Flight simulators project semi-realistic scenes of planes, landscapes, runways, and so on, at rates up to 25 fps. To acheive these speeds graphics computers use dedicated hardware to handle such tasks as clipping, anti-aliasing, rotating, and shading.

The Bosch FGS-4000 is one of the more advanced systems, suitable for generating the sort of animation used in advertising and TV title sequences. So long as only a limited number of polygons are involved the FGS can rotate or translate 3D shapes in perspective view, and supply effects like shading and anti-aliasing — all in real-time. For animation you need only to define two "key" frames at the start and stop positions: the FGS then creates a sequence by a process known as "inbetweening".

Needless to say very few of these effects are possible on home micros. To achieve high quality graphics micros will need more



memory, greater resolution, and more processing power.

Larger memory capacities and greater resolution go hand in hand. Take the memory required to hold a picture with a resolution of 1024 by 1024, giving over million pixels. If you want to have up to 256 colours on screen simultaneously you must allocate one byte for each pixel. Altogether this amounts to 1024K.

Since 8-bit processors can only address a maximum of 64K, high resolution on home micros will thus demand 16 or 32-bit processors. More powerful processors will also be able to handle the amount of number crunching needed for 3D perspective graphics: 8-bit processors are simply too slow.

Spectrum speed limit

To give an example, the Spectrum 3D Rotator program in this issue rotates a cube at a respectable rate of 10 frames a second. Written in machine code it probably represents the limit of the Spectrum's speed. But it only handles a wire frame figure and when two cubes are rotated the routine is considerably slower.

Nonetheless the prospect for graphics on home computers looks promising. Advance graphics chips are being developed for 3D image processing, while the cost of large memory stores is falling. One forecast suggests that in 10 years personal computers will come with 1024 by 1024 resolution and built-in anti-aliasing. When systems like this appear then the home user might indeed be able to start creating Loren Carpenter's imaginary landscapes. ■

BBC's Sportsnight kicks off with a graphics title sequence by Electronic Arts.

Spot the difference: the QL running a Compuser monitor and a Sony television.

ALL HOME COMPUTERS have a TV output to enable owners to use their TV set as the visual display unit — VDU. As the level of sophistication of both computers and software increases, so does the need to display finer-detail graphics —so-called high-resolution graphics—or more text characters per line as in word processing. A TV set is not designed to cope with such demands.

Inside a computer, characters and graphics start life as separate red, green and blue signals, together with a synchronising signal to "lock the display". Most machines have a separate output socket for these signals which is used to drive a monitor. The same signals are combined together inside the computer to produce what is known as a composite video signal which for the U.K. and most of Europe would be colour-encoded according to the PAL system.

Some machines make this signal available instead of the separate red, green, blue — RGB — and sync signals. Examples are the Commodore 64 and Dragon. This is a pity since combining them in the PAL format results in very substantial losses in quality. This is due to a number of factors which relate to the PAL system, but PAL was developed specifically for encoding TV pictures and nothing else.

Incidentally the Acorn BBC computer offers a composite video output, in addition to RGB, but without the colour information, in other words a monochrome composite video signal which has not gone through PAL encoding. This makes it very useful for driving monochrome monitors in applications such as word processing.

Inside the computer, the encoded composite video signal is then passed to a modulator which converts it to a RF signal suitable for feeding into the aerial socket of a TV set. Again a certain degradation occurs. In the TV set, a tuner is used to receive the RF signal, and an IF — intermediate frequency — stage converts

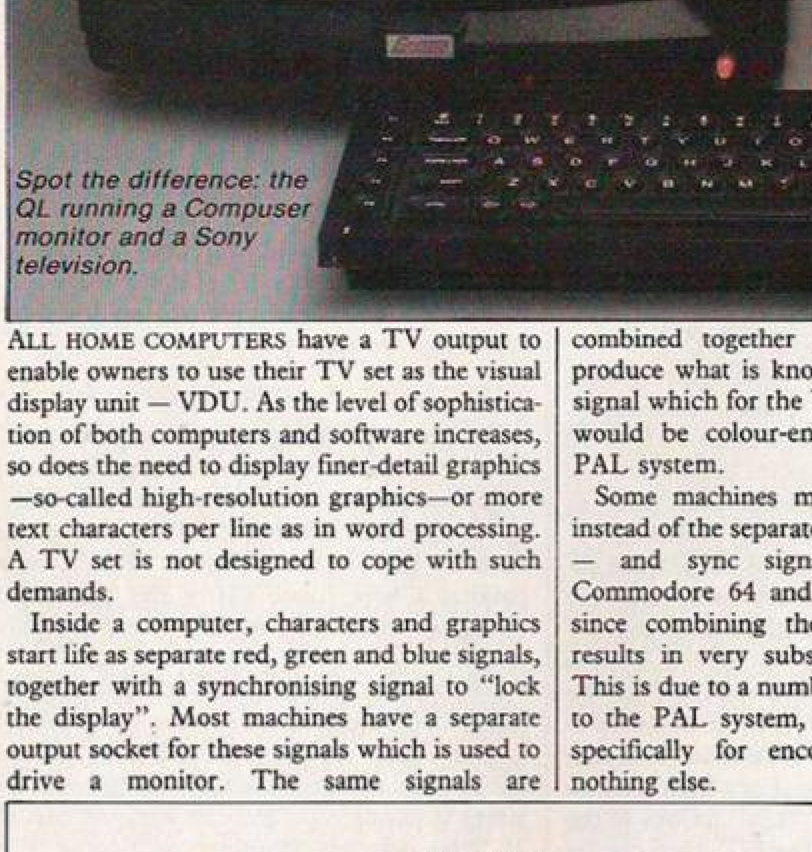


Figure 1. The encoding process is a computer.

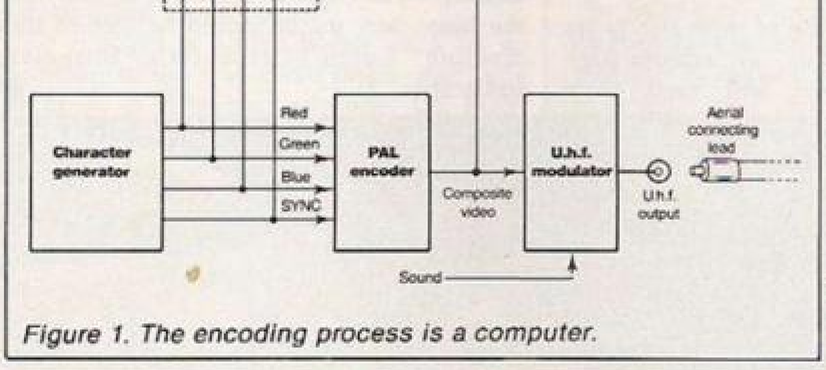


Figure 2. TV set shown in black, RGB. in red, and RGB/composite video monitor in blue.

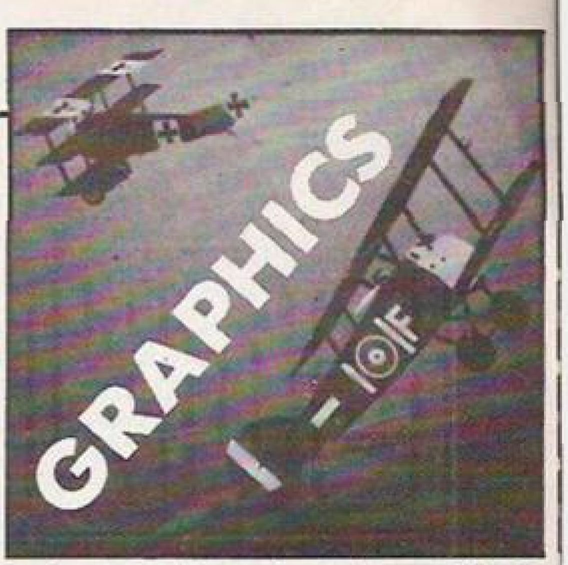
BUYERS' GUIDE

We chose eight of the most popular computers and looked at the commonly available monitors to suit each one. Use this buyers' guide in conjunction with the main article to ensure that you make the best choice. Our guide does not include TV-monitors; monitors which are designed specifically for up-market computers or monochrome monitors.

We tried to major on products which were reasonably easily available and therefore our list is not necessarily comprehensive. The prices quoted are manufacturers' or distributor prices; with some products it is possible to find them discounted so it's worth shopping around. None of the manufacturers we spoke to had done final testing on MSX products so rather than taking any risks on accuracy we decided to exclude these machines.

It is very likely that some MSX manufacturers who are also TV manufacturers — e.g., JVC and Toshiba — are likely to introduce TV-monitors suitable for these machines. In any case, the requirement is only for standard resolution and therefore it's back to TV-monitors.

MONITORS



A monitor is often high on many computer owners' shopping list. In this feature we examine the different types available and explain how to choose one that best suits your purposes; plus a buyers' guide to the most common models.

it back to a composite video signal. A colour decoder then converts it back to RGB and this is used to drive the video amplifiers and hence the tube. All this encoding and decoding takes its toll and the resulting RGB signals inside the TV set are a poor cousin to what started out in the character generator of your computer.

The best possible results are obtained if RGB is fed to a RGB monitor. Some improvement is noticeable if a PAL composite video signal is used to drive a composite video monitor.

An increasing number of TV/monitors are becoming available which combine all three, i.e., TV set, composite video monitor and RGB monitor. These are currently confined to the low end of the resolution ladder.

If you take a look at figure 2, it will become obvious that a RGB monitor is really a TV set but with the tuner, IF and colour decoder sections missing. So why are they more expensive than a TV set?

First, on purely commercial grounds, they are produced in smaller quantities than TV sets so monitor manufacturers do not enjoy the economies of scale as TV manufacturers. Secondly, the design of a monitor is different. Monitor tubes cost a lot more than TV grade tubes — standard resolution monitors use TV tubes — and more attention is paid to the geometry, setting up, picture size stability, bandwidth and many more parameters, all of which makes them more expensive to produce.

The colour tube, as found in both TV sets and monitors, has three electron guns which, when activated, each send a beam of electrons which hit a particular type of phosphor and emit visible light whose colour is dependent on the type of phosphor. The three phosphors used — one for each gun — produce red, green and blue light. The control circuitry switches each gun on.

In the case of logic — on/off — signals, the control circuitry for each gun — the video amplifier — can switch that particular gun on and off. Depending on the control commands from your computer all three guns can be on or off or of course any one or two guns can be on at any one time — in all eight permutations. Table 1 shows the control for an eight-colour computer with 0 = off and 1 = on.

Some computers offer 16 or even more colours. There are several ways this can be achieved. For example, each output can have three states: off, half-on and fully on. On a TTL 5 volt system the off state is 0V, the half-intensity is 2.5V and the full intensity is 5V. Another variation is to have an extra control bit called intensity and this method — used on the IBM PC — retains the TTL on-off signals.

An even more sophisticated approach is similar to the first example but the outputs can be level-defined under software control from 0V to 5V in several steps. The greater the number of steps, the larger the permutation of colours. A total of 64 colours is considered to be the limit, since the difference between light brown and medium brown may not be too apparent on the screen.

For the home computer owner there are two types of monitor: RGB and composite video. The latter usually has RGB input capability as well as composite video, has a built-in audio amplifier and speaker and is therefore more

(continued on next page)

Table 1.

Red Gun	Green Gun	Blue Gun	Screen colour
0	0	0	Black
1	0	0	Red
0	1	0	Green
0	0	1	Blue
1	1	0	Yellow
1	0	1	Magenta
0	1	1	Cyan
1	1	1	White

LIST 1. ACORN BBC OR ELECTRON. ORIC. RESEARCH MACHINES RM480Z.

Key: L = includes leads
G = anti-glare screen
T = green-only button
S = selective transmission glass

Manufacturer	Model	Price inc.VAT	Resolution Standard	Medium	High	Tube size	Inputs RGB	Composite video + RGB	Sound	Plastic case	Metal case	Case colour	Country of origin	Comments
Microvitec	1431/MS	£299	•			14"	•				•	brown/beige	UK	L
Microvitec	1451/DS	£299		•		14"	•			•		brown/beige	UK	L
Microvitec	1441/MS	£506			•	14"	•				•	brown/beige	UK	L
Microvitec	1441/DS	£506			•	14"	•			•		brown/beige	UK	L
Compuser	2000	£325		•		14"	•			•		cream/black	UK	L,G,S
Compuser	2000R	£325		•		14"	•			•		red/black	UK	L,G,S
Novex	1414	£215	•			14"		•	•		•	cream/black	Taiwan	L,S,T
Novex	1416	£368		•		14"	•				•	cream/black	Taiwan	L,S,T
Novex	1418	£431.25			•	14"	•				•	cream/black	Taiwan	L,S,T
Kaga	Taxan Vision II	£327.75		•		12"	•			•		cream	Japan	
Kaga	Taxan Vision III	£458.85			•	12"	•			•		cream	Japan	

LIST 2. SINCLAIR SPECTRUM.

Manufacturer	Model	Price inc.VAT	Resolution Standard	Medium	High	Tube size	Inputs RGB	Composite video + RGB	Sound	Plastic case	Metal case	Case colour	Country of origin	Comments
Microvitec	1431/MZ3	£259	•			14"	(special interface)		•			Black	UK	L
Compuser	2000S	£370		•		14"		•	•	•		Black	UK	L

(continued from previous page)

expensive. Incidentally, a composite video monitor can be used to advantage with a modern VCR which has video and audio outputs — most have. The choice depends on which computer you own.

The next variable is resolution. First, let's define resolution: it is the ability of a monitor to display clearly or resolve a given number of pixels or picture elements. Your computer sees the monitor as a sheet of graph paper and controls each "square" individually. The degree of required resolution is dependent on both the computer's capability and the software. There are three common grades of monitor: standard, medium and high.

Standard types use TV grade tubes which have a "pitch" of around 0.6mm. The pitch is the distance between adjacent groups of phosphors on the face of the tube. This is by far the most important parameter which determines a monitor's resolving ability. The closer the distance between the phosphors, the greater the number of phosphor groups — a group contains three phosphors — one red, one blue and one green — that can be squeezed in over the face of the tube and therefore the more pixels it can resolve.

Gives excellent results

Going back to standard resolution monitors, a 14 inch 0.6mm pitch tube will resolve around 450 pixels per horizontal line. This gives excellent results for text which has 40 characters per line. A 20 inch equivalent using a 0.8mm pitch tube is capable of around 500 pixels. Notice that the degradation of pitch — from 0.6 to 0.8mm — is more than made up for by the increased screen size which simply allows more phosphor groups to be laid down.

Standard resolution monitors are available in both RGB and RGB/composite video versions. We do not, however, recommend them since they represent very poor value for money compared to a TV-monitor like the new Ferguson MC-01. As far as performance is concerned there is nothing to choose between any standard resolution monitor and a TV-monitor so, unless there is a special reason such as a requirement for a metal-cased unit, we suggest you look around and compare deals on TV-monitors.

The next step is medium resolution. For a 14inch tube with a nominal pitch of 0.43mm, the resolution is about 580 pixels. Again these are available in either RGB only or RGB/composite video with sound. For most applications and for most computers, this is the resolution we would recommend. Prices have come down recently and they now represent good value for money.

A medium resolution 14inch monitor will resolve 80 characters per line — just! If you use your computer in this mode for most of your work, it isn't quite good enough but it is a substantial improvement overall as compared to standard resolution.

If you do make extensive use of 80-character text — word processing for example — then we would strongly recommend that you buy a monochrome monitor for around £80. These give a better display than any colour monitor at a fraction of the price but they are no good for games or any program which has colour graphics. The only other alternative is a high resolution colour monitor. Staying with our example of a 14inch unit, these have a pitch of 0.31mm and a resolution of about 800 pixels.

Table 2.

	Games or general use	Text or business use	Combined
TV-monitor	1	0	1
Standard-res.	0	0	0
Medium-res.	2	1	2
High res.	0	2	1
Mono-chrome	0	2	0

Key: 0: Not recommended
1: Will do
2: Good

Bear in mind that these ratings take many different aspects into account, including price, and they are therefore subjective.

They are perfectly suitable for 80-character use but they are very expensive — over £400. This tends to put them beyond the reach of most home computer users unless you are using your computer as a business tool or have a lot of money. Table 2 is a quick reference.

Bandwidth figures meaningless

Video bandwidth figures are very often quoted but are really quite meaningless and you should not use them as a measure of the overall display quality. Video bandwidth is the ability of the video amplifiers in a monitor to reproduce high frequency — i.e., fast switching — signals without degradation. It is quoted in MHz or megahertz and is usually the frequency at which the output of the amplifiers drops by 3dB as compared to lower frequencies.

It is the monitor designer's job to ensure that there is more than adequate bandwidth for the type of tube used. As a guide, a standard resolution TV-type tube requires 6MHz, a medium resolution tube around 10MHz and a high resolution tube about 12MHz. No advantage will be gained if you drive a standard resolution tube with 20MHz amplifiers. ■

LIST 3. COMMODORE 64. DRAGON. ATARI.

Manufacturer	Model	Price inc.VAT	Resolution Standard	Medium	High	Tube size	Inputs RGB	Composite video + RGB	Sound	Plastic case	Metal case	Case colour	Country of origin	Comments
Microvitec	1431AP/MS	£259	●			14"		●	●		●	brown/beige	UK	L
Microvitec	1431AP/DS	£259	●			14"		●	●	●		brown/beige	UK	L
Microvitec	1451AP/MS	£375		●		14"		●	●		●	brown/beige	UK	L
Microvitec	1451AP/DS	£375		●		14"		●	●	●		brown/beige	UK	L
Microvitec	2030/CS5	£443	●			20"		●	●		●	brown/beige	UK	L
Microvitec	2040/CS5	£788		●		20"		●	●		●	brown/beige	UK	L
Compuser	2000C	£370		●		14"		●	●	●		cream/black	UK	L,G,S
Compuser	2000K	£370		●		14"		●	●	●		grey/grey	UK	L,G,S
Novex	1414	£215	●			14"		●	●		●	cream/black	Taiwan	L,S,T
Kaga	Taxan Vision Ex	£247.25	●			12"		●	●	●		cream	Japan	

LIST 4. SINCLAIR QL.

Manufacturer	Model	Price inc.VAT	Resolution Standard	Medium	High	Tube size	Inputs RGB	Composite video + RGB	Sound	Plastic case	Metal case	Case colour	Country of origin	Comments
Microvitec	1451/DQ3	£275		●		14"	●			●		Black	UK	L
Microvitec	1451/MQ3	£275		●		14"	●				●	Black	UK	L
Compuser	2000Q	£325		●		14"	●			●		Black	UK	L,G,S
Kaga	Sinclair Vision QL	£299		●		12"	●			●		Black	Japan	

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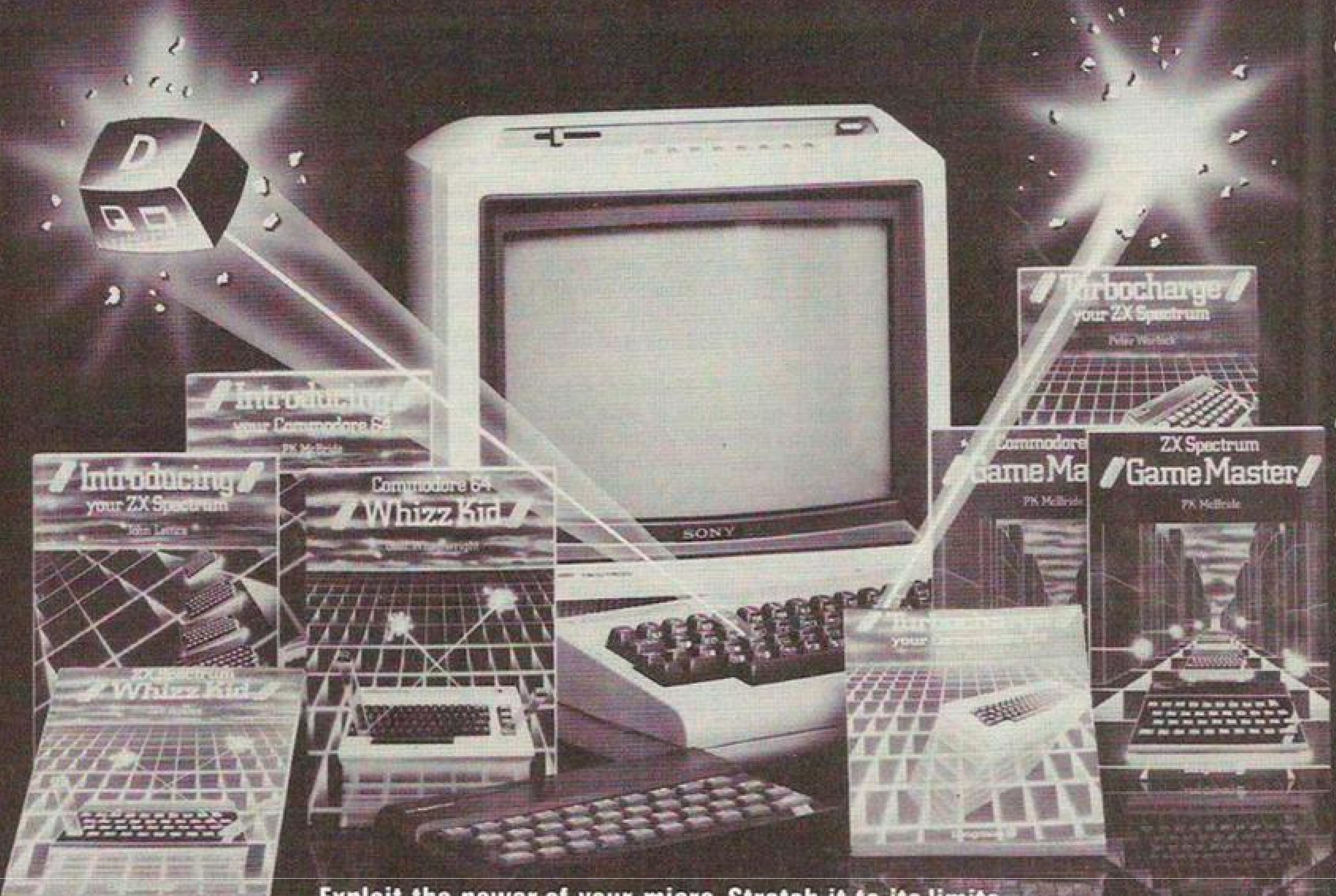

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FLIGHT SIMULATORS

Mike Gaines flies a reconnaissance mission for *Your Computer*.

MOST BOYS from 8 to 80, dream sometimes of becoming a fighter pilot — whether the First or Second World War variety with silk scarf and leather helmet — or the modern Darth Vader lookalike. Few get the chance to try their hand in an aeroplane, even fewer make it on a fighter squadron. And then there are those who fancy a career driving airliners full of sunburnt tourists clutching stuffed donkeys back to Gatwick or Luton.

I'm luckier than most, I get to pick and choose what I fly in, when I fly, and what sort of flying. So I am fairly *au fait* with most types of lufting. But the great thing about flying a simulation program is that you don't get hurt by your mistakes and that experimentation is possible. Can you barrel roll at F-15 at 200ft and get away with it? The computer says yes, although I wouldn't recommend attempting it in the real thing.

Fighter Pilot puts you in the cockpit of a McDonnell Douglas F-15 Eagle. The program is well written, within the bounds of what has been published on the F-15 — remember its the latest US Air Force fighter.

The aircraft handling is realistic and aerobatics are possible in all planes. The view from the cockpit is daytime, with green land and blue sky. Five modes are available; landing, flying training, blind landing, air combat training, and combat. In the latter you are on ground alert at base with responsibility to defend it, plus three other airfields.

The instrumentation is good with clear easy-to-read digital read-outs of height, speed, and rate of climb/descent. The attitude indicators consist of a small articifial horizon type aeroplane for roll, with a two-colour pitch ladder — nose up/down — which is particularly useful as the outside visual shows only unrelieved green or blue.

A multi-role indicator gives enemy aircraft — bogey — height or distance in latitude and longitude. A "radar" shows the bogey's position from you in azimuth — or your position from a beacon, if selected — his range/bearing and your heading. A strip read-out gives thrust, turning red when afterburner is selected — watch your fuel level drop accordingly. Other indicators show flap/gear positions and cannon rounds remaining.

The basic idea is to take-off — hold it on the brakes till full afterburner is engaged, then whip the gear up quick, pull to 90 degrees pitch and zap up to 30,000 ft, cancel the burners and pull inverted, roll out, and select map; a quick glance at where the bogey is heading then set course for intercept. Switch on the gunsight and the flight computer for a read-out of the enemy aircraft's height. When you've got the bogey dope, work out your tactics. The program will only let you see the other guy at ranges of less than a mile and within 5,000ft height difference. This makes a head-on pass — you only have guns, no missiles — practically impossible but you can get in below him and as the range comes down to a mile, pull hard and roll out in his six o'clock position.

Overall, Fighter Pilot would be hard to improve besides the addition of radar and heat-seeking missiles and some ground detail. Terrific fun *and* realism — will the programmer, D.K. Marshall, now write a similar ground-attack game based on, say, the Harrier?

A different game altogether is Nightflite II, again played on the ZX Spectrum. This puts you in the seat of a light aircraft. The visuals depict a runway flarepath at night with a few random lights dotted around. This is purely an airmanship trainer. I found it both excellent and fascinating. The best mode is the one that dumps you in the middle of nowhere and you have to navigate back using VOR and ADF plus a DME, to intercept the ILS to land. The only hazards are mountains to the north and west of the field.

After trying Fighter Pilot, my first reaction to Nightflite was to find it boring. But it really is a more exacting and realistic test of your flying skill than blasting about kidding yourself that you can fly because you can loop at 30,000ft. An interesting light aircraft variation could combine the best of both worlds, with a day visual and performance based on that of the Pitts S-2 Special.

Protek's Airliner I found quite frankly, awful. The graphics consist of a very crude representation of an aircraft cockpit. If the Ancient Egyptians had launched papyrus and bamboo aircraft from the Pyramids then this is the type of instrumentation they probably would have developed for night/blind flying. The blurb says that the program represents a BAC1-11 airliner and indeed, this aircraft's silhouette is shown on a pink (!) artificial horizon. There is no view of the outside world, just a bunch of crude dials and the pink airliner.

Game	Company	Price
Airliner	Protek	£5.95
Fighter Pilot	Digital Integration	£7.95
Flight Simulator II	SubLogic	£40.00
Nightflite II	Hewson Consultants	£7.95
Solo Flight	MicroProse Software	£14.95
Spitefire Ace	MicroProse Software	£9.95
Sub Hunter	Micro Mart Software	£6.95
Wing Commander	Creative Sparks	£7.95

You type in the call-signs of various navigation aids in the Edinburgh area — watch the read-outs and dials churn over and set up for a blind landing or, by changing modes, obtain a view of the airport on the "head-down-display" — neé artificial horizon and map — it's rather like piloting a letter box. This is a shame really, the basic program is pretty good but ruined by non-realistic presentation. After all, if you don't get the "feel" however slight that you are actually airborne then there is not much point is there? In its present format it's like watching a bunch of clocks, truly boring.

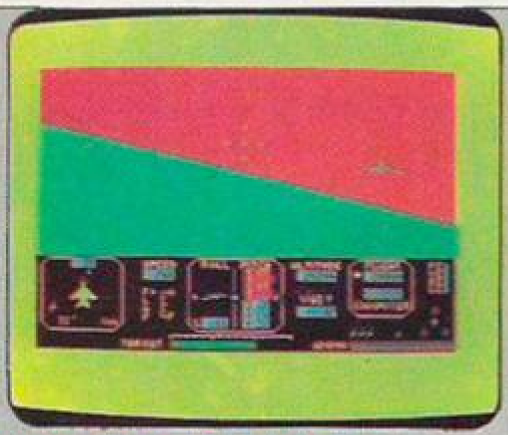
A completely different kettle of fish is J Dyer's Sub-Hunter., This excellent program simulates the RAF's Nimrod, a large four-jet designed specifically to hunt and kill submarines.

An extremely complex program, as evidenced by the time taken to load into the Spectrum Plus, Sub-Hunter reflects the sophistication of the real aircraft — Nimrod is the most advanced aircraft of its type in the world. Sub-Hunter itself is probably more complex than the real anti-submarine aircraft of only 20 years ago — still in service with some nations.

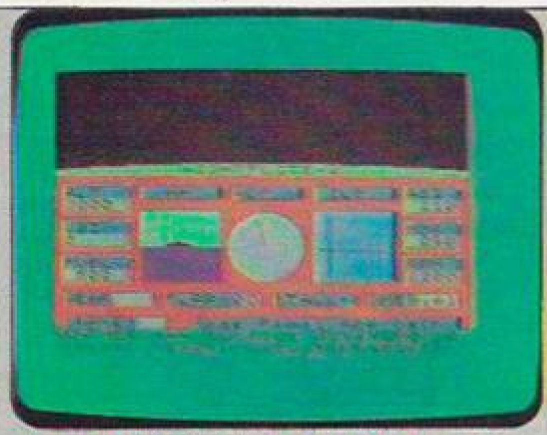
In this game, a submarine is submerged somewhere within a 24n.m^2 area of ocean. All you have to do is detect it, locate it and kill it. To aid you the aircraft has three main sensors — four counting the radar which, on game start, tells you very roughly where to start searching. The Magnetic Anomoly Detector — MAD — picks up variations in the Earth's magnetosphere caused by large metal objects such as a submarine. Switch this on and get low, it only works at low level.

Other sensors are passive and active sonobuoys. These are dropped into the water and transmit data back to the aircraft. Passive buoys only listen for the sub and can only detect noise sources within two miles. The active buoys transmit a "ping" and can detect a sub out to three miles. But the submarine can hear an active buoy and take evasive action accordingly. Both buoys have a life of 15 minutes so don't drop the lot at once.

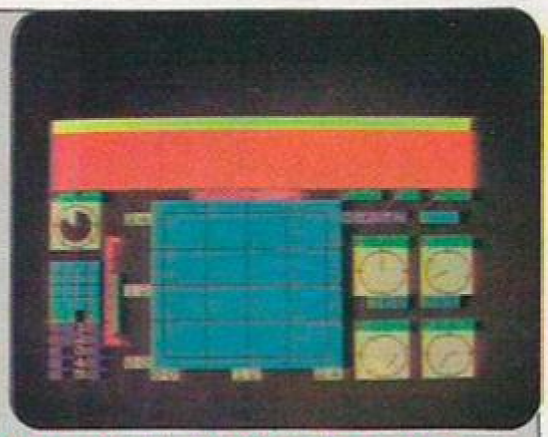
This game is quite complex and realistic and can be played by two or three people; one flies the aircraft, one looks after buoy and weapon dropping while another acts as captain, directing the other two — great fun.



Above: Fighter Pilot from Digital Integration.



Above: Nightflite II from Hewson Consultants.



Above: Sub Hunter from Micro Mart Software.

Another realistic game is Wing Commander which is played on a Commodore 64. Once again this is a fighter game. The basic mission is to defend an island which, probably coincidently, looks a bit like East Falkland. On the island are two airfields, two naval bases, an industrial complex and a couple of cities, with a ship anchored offshore. These are targets, you are on the end of the runway in an F-15-similar fighter armed with cannon and four Sidewinder heat-seeking missiles.

The visuals are quite good, although the aircraft handling is not as crisp as that of Fighter Pilot. One annoying point is that the speed is shown in rather unusual feet per second or somesuch, instead of knots.

However, this program has what Fighter Pilot lacks, the ability to perform head-on missile attacks.

Another refinement of Wing Commander is the ability to refuel in the air. The height, speed, and heading parameters to achieve this are quite strict but this is realistic enough.

Spitfire Ace, from Microprose for the Atari and Commodore Micros, is not really a flight simulator, more of a joystick-operated air-combat game. You do get a view out of the cockpit window, with a gunsight, and you get to chase and shoot down enemy planes.

However, the control panel is rudimentary, the scenery primitive, and the simulation is wholly unrealistic. Everything happens at arcade game speed, and there seems to be no relation between what you can do with the Spitfire you are supposed to be flying and the real thing.

The game appears to offer 14 different scenarios such as France, Blitz, D-Day and so on, but they all look about the same — except the ones that take place at night. The ground is detailess green, which makes landing or ditching tricky.

Neither as a combat game nor as a simulation is Spitfire Ace as good as Star Raiders. However, in dog fights it does get you leaning from side to side in your chair, so it must have some species of merit.

Solo Flight, also from Microprose for the 48K Atari and Commodore micros, is reasonably complex. It offers a good control panel at the bottom of the screen, and a three-dimensional view of the landscape at the top. This has a few mountains on the horizon, and some sketchy airfields on the ground. The Atari version adds shading through the use of display-list interrupts which, of course, the Commodore 64 can't do.

The odd thing about the graphics is that you can see your own little plane through the cockpit window. The resulting loss of realism makes it more like flying a toy plane.

Like Spitfire Ace, Solo Flight is a joystick-operated game.

Below: Flight Simulator II from SubLogic.

If you get tired of flying you can play a mail game — you have to deliver bags of mail to five different airports in the shortest possible time.

Solo Flight offers three different areas to fly in — Kansas, Washington/Oregon and Colorado. You can also fly by instruments, if you can work out what's going on. Amazingly enough, there isn't a cockpit diagram in the 16-page handbook supplied.

Apart from that, Solo Flight is a pretty good simulator. Unfortunately it pales into insignificance against Flight Simulator II.

Bruce Artwick's Flight Simulator II is now the unchallenged leader among flight simulation programs for micros. It's available from SubLogic for everyone with an Apple, Atari or Commodore 64 with a disc drive and around £40 to spend.

The program is an accurate simulation of flight in a Piper 181 Cherokee Archer. Over 40 controls and indicators are shown on screen, along with a colourful three-dimensional view out of the cockpit in the direction of your choice — front, back, either side and down.

The instrument panel includes all the usual stuff plus two navigation radios, clock, magneto switch position indicator, gauges for the right and left fuel tanks, mixture and throttle control indicators, and aileron, elevator and rudder control indicators and lots more. These help you to fly day or night, and in this simulation, one does change logically into the other.

The flying area covers all of North America, which is mostly blank, with detailed landscapes on a separate disc for four separate areas: Chicago, New York, Seattle and Los Angeles. Other areas are now being coded using maps, charts and aerial photographs.

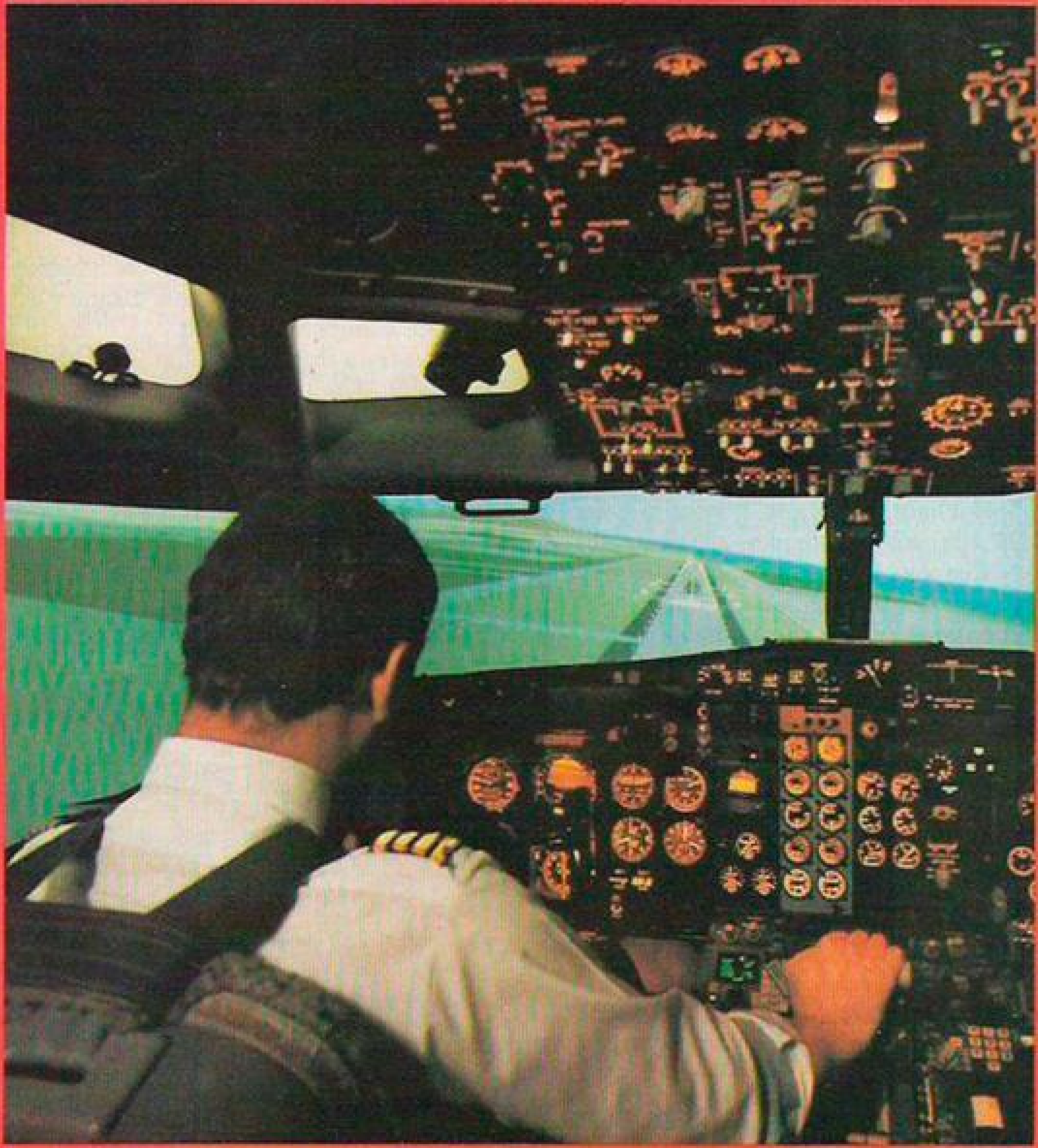
The simulation also provides a choice of four seasons, cloud layers, surface wind and wind at three levels — with turbulence factor — as much nasty weather as you could want, and more.

All of this is explained in great detail in a 90-page manual. There is a second 92-page manual of Flight Physics and Aircraft Control, with an introduction to aerobatics. This ends with the warning "Please do not attempt these maneouvres in actual flight with a real airplane unless accompanied by a qualified flight instructor experienced in aerobatics" — meant to be taken seriously. You really start to think that if you can fly this simulator you can fly anything!

If you get tired of aerobatics there's also a "World War 1 fighter ace" mode. ■

REACHING FOR THE SKY

Simon Beesley looks behind the simulated scenes at Rediffusion's "flying" machines and discovers an amazingly believable display.



IN THE FIELD OF computer graphics Britain has lagged behind. The most interesting work, such as ray tracing or feature film animation, is being done in America and Japan. The one exception here is in the graphics used on flight simulators.

Rediffusion Simulation is one of the top three companies in the world manufacturing flight simulators. At the company's factory in Crawley, Sussex a number of simulators are lined up in two rows. With their flight cabins perched 25ft. up on six hydraulic jacks, they look like forerunners of George Lucas' At-At Walkers from *Star Wars*. One of them is in operation but the only sign of it is that the jacks have extended a further 5ft. The pilot is probably cruising smoothly at 30,000ft.

To enter the cabin you mount a ladder. Inside there is a perfect reproduction of the interior of an aeroplane cockpit — from the instrument panel right down to the seat covers. But most startling is the view out of the window.

For those who want a technical description, it gives a field-of-view which extends 200° horizontally by 40° vertically. Five calligraphic projectors throw the image on to a back-projection screen. It is then reflected into the flight deck by a large diameter collimating mirror. This system, named the Wide II display, is unique to Rediffusion's simulators. Less advanced models use monitors clamped to each window.

What the mirror shows is an amazingly believable computer generated display with real-time animation. From the air, at least, features like fields, mountains, and airport buildings look remarkably realistic. Other

planes, in particular, are shown in fine detail complete with markings and transparent canopies.

Along with these, the display can reproduce a variety of atmospheric effects: clouds, fog, horizon glow, and at night or dusk a twinkling constellation of city lights.

Perhaps the most impressive scenes are produced on the units which simulate fighter planes. On these you can practise formation flying, refuelling in mid-air, or bomb a variety of moving and stationary targets such as bridges, factories, trains and patrol boats.

If you plump for air to air combat you can do battle with another pilot or take on the computer. The average arcade fan would feel instantly at home here. The difference is that the visual effects, which include anti-aircraft flak, explosions and heat seeking missiles, are a hundred times more convincing.

On top of this the flight cabin threatens, at times, to tip you out of your seat. At take off the cab tilts up and from then on the motion control system supplies the sensations you would experience in an actual flight — smooth low-velocity movement, rapid acceleration, G-forces, banking from left to right, the lot.

All this is delivered by six hydraulic jacks which are both extremely powerful and highly responsive. They can rotate the cab in six axes as well as move up and down, forwards and backwards. Helicopter simulators also include vibration platforms.

Pre-recorded sounds extend the illusion with engine noises and the whistle of the air-flow, or, on helicopter simulators, the sound of rotors and gear changes.

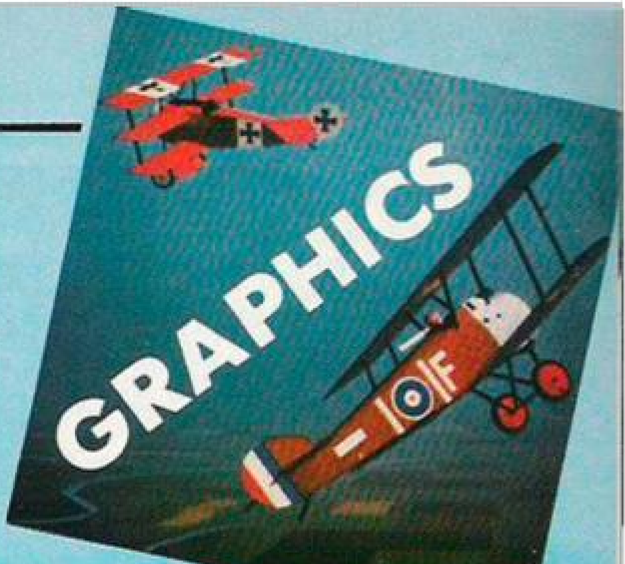
Flight simulators, in fact, reproduce all the sensations of a real flight, short of smell. They have to, in order to satisfy airline authorities' training regulations. Pilots now receive a large part of their training on simulators. And Britain's Civil Aviation Authority even tests simulators for air-worthiness, as it would a real aircraft.

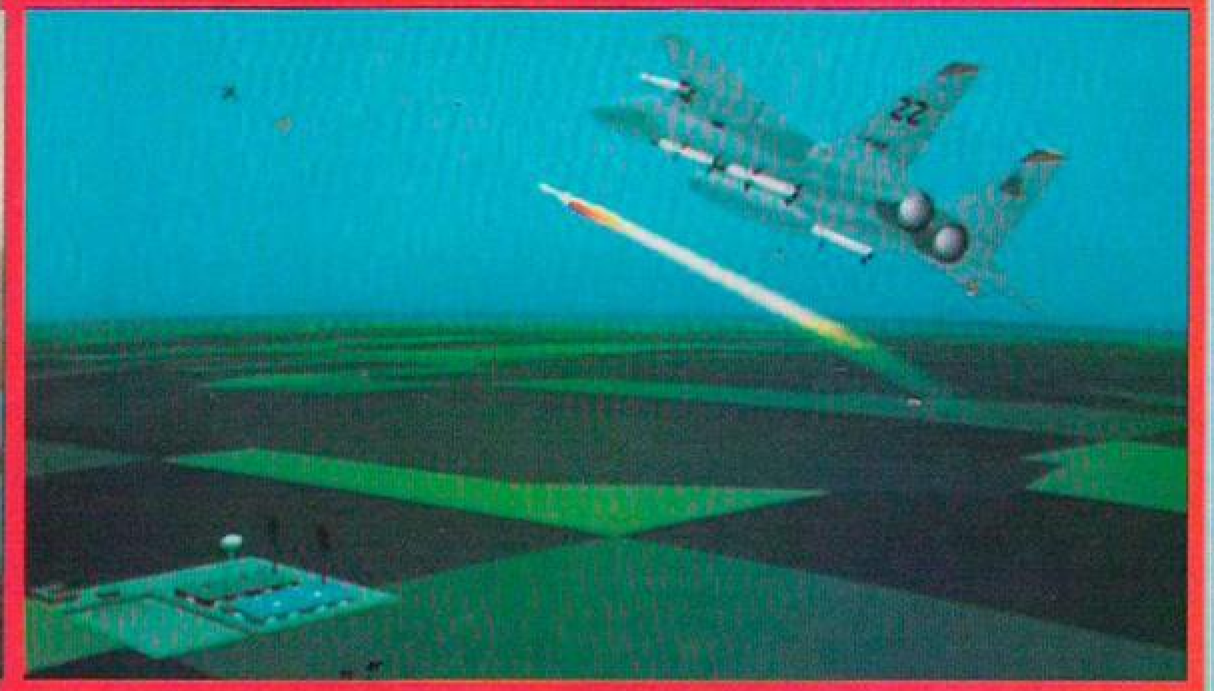
The costs of training on real aircraft are enormous. A Jumbo, for example, consumes 2½ tons of fuel in take-off alone. So learning to fly on a simulator is a lot cheaper.

It is also, of course, safer. You can practise coping with an engine failure, or landing on an icy runway — without leaving the ground.

Another advantage is that simulators are delivered with visual databases which match the features of particular airports. Pilots can familiarise themselves with the layout of runways and buildings at Heathrow, Washington, Hong Kong, or any major airport.

For a radius of up to 15 miles around the airports the databases hold the features of "real-world" terrain. Real-world means that the terrain corresponds to navigation maps. In other words, you will find a river where you expect it to be. The objects on the ground are not shown in the same fine detail as the planes themselves. While objects like trees or buildings appear solid and shaded, they tend to have a rather Toytown look about them.





But flight simulator companies are constantly improving the quality of their displays. As John Bastow, Visual Sales Manager for Rediffusion, put it, their customers are shrieking for more realism: "They want to see leaves on the trees, or the wind rippling a cornfield". The latest systems map texture patterns on to horizontal surfaces to simulate waves or grass. Effects like these are not just cosmetic: close to the ground they give the pilot valuable height and speed cues.

As it is, flight simulator graphics are the most advanced examples of computer animation to be found. A typical image might be built up from over 1,000 polygons, shown in perspective view, and smoothly shaded. The pixel resolution is around 600 by 700.

To generate images of this complexity at a rate of 25 frames per second calls for very specialised hardware. The task has to be distributed to a number of processors which work simultaneously on different parts of the problem — clipping, anti-aliasing, computing 3D transformations, and so on. Rediffusion's simulators use image-generating processors made by Evans and Sutherland, coupled to a fast 32-bit Gould computer.

Not surprisingly none of this equipment comes cheap. The image generators cost more than $1 million while a complete flight simulator carries a price tag of at least $5 million. Rediffusion only sell 10 of them a year and each takes 18 months to build.

All of which rules out the possibility that first occurs to most home computer owners — that a flight simulator would make the ultimate video game.

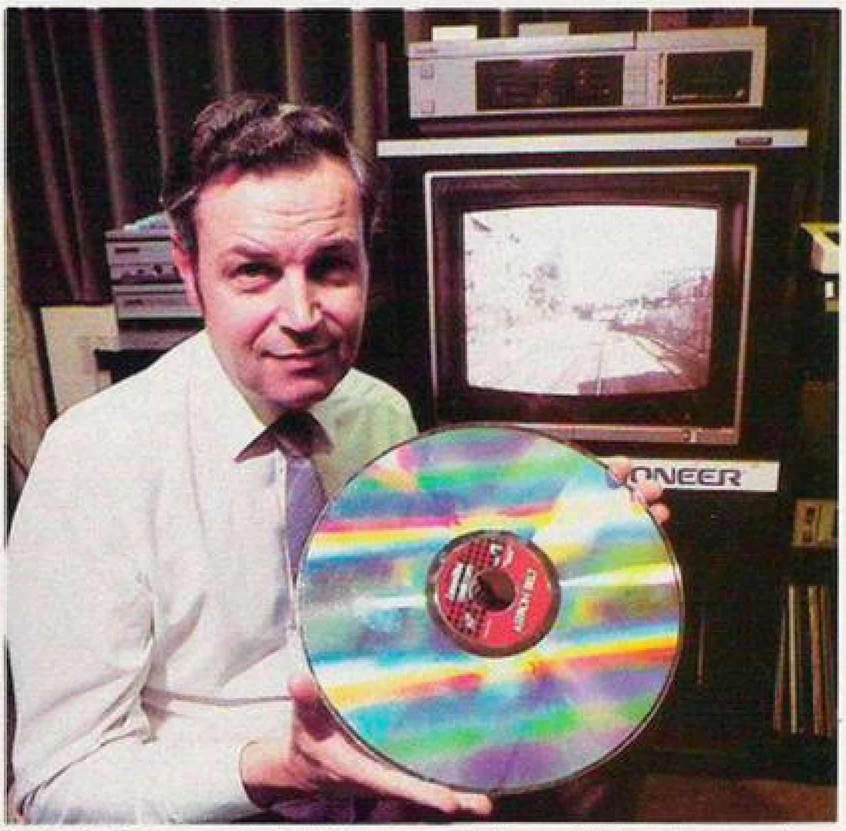
For the moment we will have to be content with Rediffusion's first leisure application, a space ship simulator. This uses the motion control system without the computer graphics. Instead the cab's movement will be synchronised with film sequences.

When it opens next year in Toronto, this venture will take visitors on a simulated tour of the universe. Rigged out as a space capsule, the interior of the cab will house a 40-seat cinema.

The system could also be adapted to simulate a ride down the Cresta Run or a dog-fight. Of course it is still a poor substitute for a ride in a proper flight simulator. It lacks the all-important feature which computer graphics supply: the ability to control the scene yourself. But it may be some consolation to know that you can use a simple joystick to resynchronise the leisure capsule. Apparently you could even run the necessary software on a BBC Micro. ■

LASER DISCS

Merion Jones looks at games machines which use laser discs for more realistic action.



BORED WITH WORK you sit down in a special chair and as the lights fade one wall of the room dissolves to reveal deep space rushing past filled with images of hostile spacecraft plunging towards you. As you fire the lasers the whole chair seems to shake with the shock.

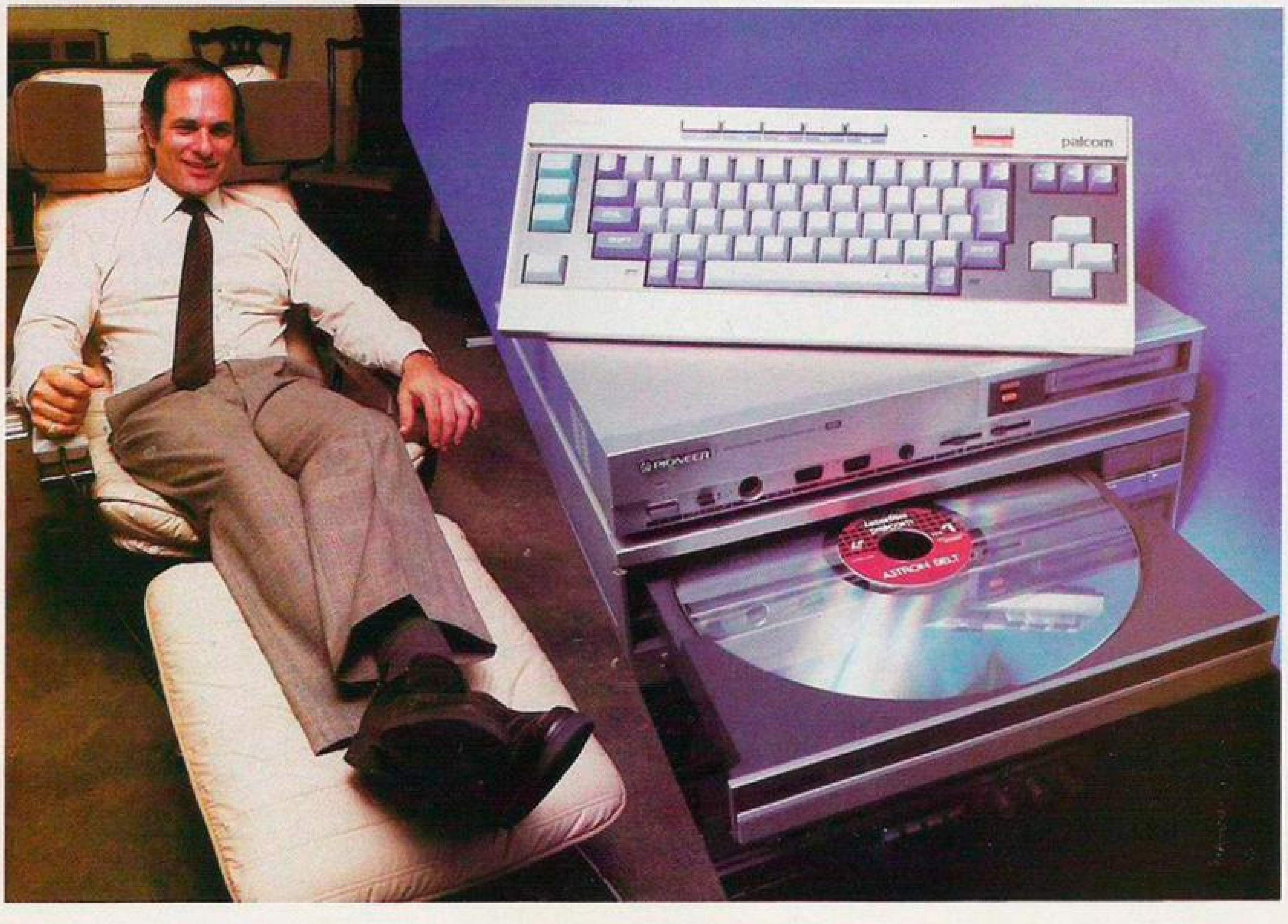
Science fiction — not quite. Next spring Pioneer intends to start selling its PX-7 MSX computer in Britain together with the new LD-700 laser disc player. These are designed to interface together so you can play the Dragon's Lair and Astron Belt style arcade games which combine sequences of real film or animation and computer graphics on screen to produce the most realistic video games yet.

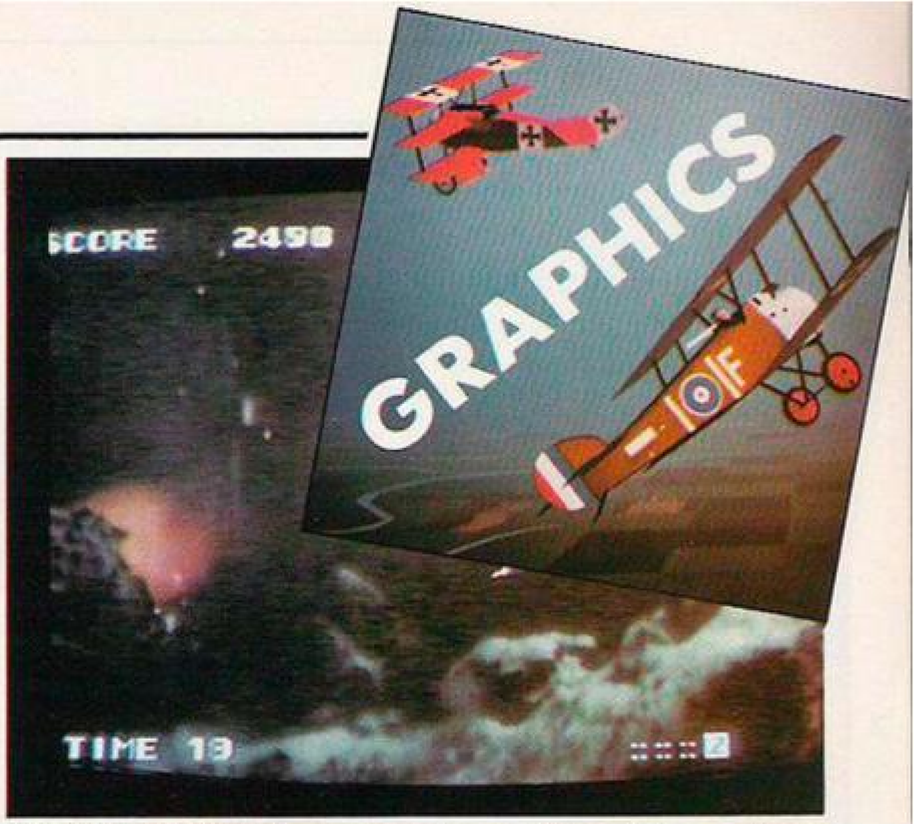
Instead of waiting for the slow progress in colours and resolution to drag computer games out of the stone age as far as graphics is concerned we can jump straight to the sharp focussed images of film and television.

In America RDI Video Systems, the company which developed the technology to bring Dragon's Lair to the arcades, has already launched a similar video-disc based games machine for the home called Halcyon. Halcyon has the additional gimmick of voice synthesis and recognition so you can shout your instructions to it as you play games like The Spirit of Whittier Mansion — a horror film which stars you.

In Europe Philips, the company which first developed laser discs, has launched its first MSX computer and is now working on interfacing that to its Laservision units to produce the same effect. Back in Japan one of Pioneer's rivals, JVC, has just released its third MSX computer which interfaces to its VHD video disc, again to combine film and graphics on screen. One of the games for the JVC is a version of Pole Position using film of a real race track. In Britain Acorn has been using Pioneer's laser disc linked to a BBC Micro as the basis for its interactive video project.

Meanwhile somewhere in North West





London in a heavily curtained room Pioneer has been demonstrating its system with the added sophistication of the Bodysonic chair. You slide the shimmering Astro Belt laser disc into the front loading LD-700 video player and then sink into the Bodysonic while the LD-700 downloads the control program into the PX-7 which is a standard MSX computer apart from its video interface capability.

Both the PX-7 and LD-700 are designed to fit into a standard Pioneer Hi-Fi rack — 19 inches wide, a couple of inches high with all the controls on the front — in the PX-7's case including slider volume controls. The keyboard is a separate IBM PC style detachable. The Japanese NTSC models use a silver and lilac colour scheme but the British models will be the traditional high-tech funereal black.

When you're seated comfortably and the program is loaded your encounter with the Astro Belt begins. On to a background of Star Wars style film clips generated from the disc the computer throws a crude outline of what is supposed to be your ship up on screen. The control program already loaded synchronises the locations that you fire at with the position of the filmed attackers on screen and if you hit them a rough and ready computer generated explosion marks the spot.

As you sit in the Bodysonic chair all the sound is fed to you through speaker wings on either side of your head. Meanwhile three sub-sonic transducers, one in the footrest and two in the chair, shake your whole body every time your ship is hit — using the same Surround-sound system specially equipped cinemas used when showing earthquake or volcano movies.

Geoff Pflaumer, who is in charge of marketing the video system for Pioneer, explains how the game becomes more challenging at higher levels: "They tend not to shoot back so much on level one — but on level five if they shoot you actually die — 25,000 volts are fed through to the chair". For a second you wonder, and perhaps take a little more care in picking off the aliens before remembering that Pioneer has abandoned its old slogan "Everything you hear is true", and traded it in for "The future of sound and vision".

Using laser discs should mean more than just better computer games — it should also help to unleash the educational potential of micros. Because laser discs use millions of reflective pits scanned by laser they can hold tremendous quantities of information — 36 minutes of film on one side of a disc or 108,000 still pictures. As Geoff Pflaumer puts it, "You could contain the Encyclopaedia Americana, Brittanica plus any other encyclopaedia of your choice on one disc".

On the next disc in your collection you could have "every picture in every museum in the western world". The other advantage is that because the surface of the disc is sealed in a transparent layer and the playing mechanism does not touch the surface of the record they should survive almost indefinitely.

They are certainly tough — Geoff Pflaumer insisted on demonstrating this by dancing up and down on one. The alternative to laser discs is JVC's VHD — very high density — discs.

But none of these systems can conveniently be used to record information so they could never take over from floppy discs or cassettes as the main computer storage media. They have also sold in very small numbers compared to video cassette recorders — there are six million VCRs in Britain now — and VCRs have the added advantage that you can record, so what is the computer industry doing to make use of this resource?

The problem with video cassette recorders is access times and lack of random access. Six seconds is the maximum search time for any of 54,000 still pictures on a laser disc even on a domestic unit. You could not implement high-speed race track or space combat sequences easily on a VCR based computer system but you could use it for adventures and education.

Ivan Berg is one of the software houses working on video-based programs. The Pioneer PX-7 will work equally well superimposing text or graphics on VCR-generated pictures. Also next spring JVC will launch their second MSX machine here which will be designed to work with VCRs. ■

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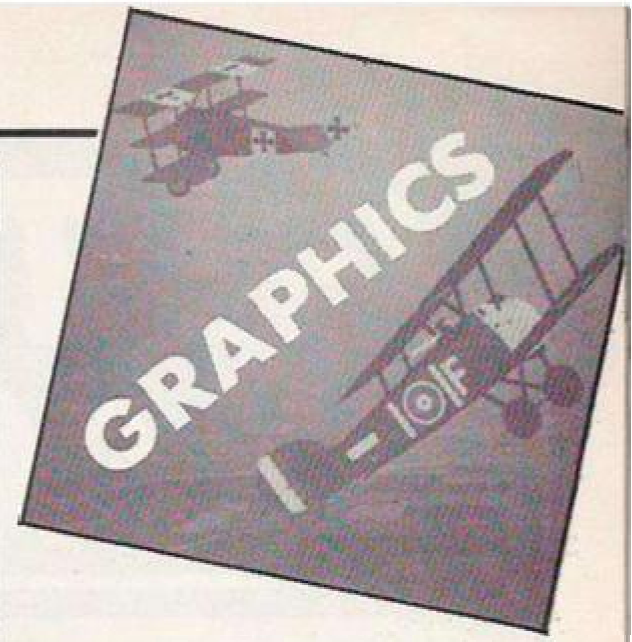


Table 1.

Offset	No of Bytes	Parameter	Description	Range
0	1	NUMB	Number of sets of data.	1-255
1	2	ADDR	Start address of data.	
3	2	PX	X co-ord (+VE LEFT)	
5	2	PY	Y co-ord (+VE UP)	
7	2	PZ	Z co-ord (+VE FORWARD)	
9	2	PHI	Angle about X axis	0-359°
11	2	THETA	Angle about Y axis	0-359°
13	2	PSI	Angle about Z axis	0-359°
15	2	DRAWS	Address of free memory after 3D data	
17	2	DRAWP	6*NUMB + DRAWS	
19	1	STFLG	Poke this with 0 the first time you use the 3D image.	0 or 255

3D ROTATOR

Mark Jones with a program which makes his 3D rotator published in the July 1983 issue up to eight times faster.

IN JULY OF LAST YEAR, I wrote a program for *Your Computer* called 3D Rotator. This program allowed the Basic programmer to manipulate simply defined 3D figures at machine-code speeds. A typical time was 0.5 seconds for a cube. Though this was extremely fast relative to Basic it was not fast enough for practical dynamic games. With this in mind I have speeded up the 3D routine by as much as eight times and made it more versatile. The speeds achieved now are as fast as those seen in commercial games such as 3D Tank Duel, with the advantage that they can be called from Basic.

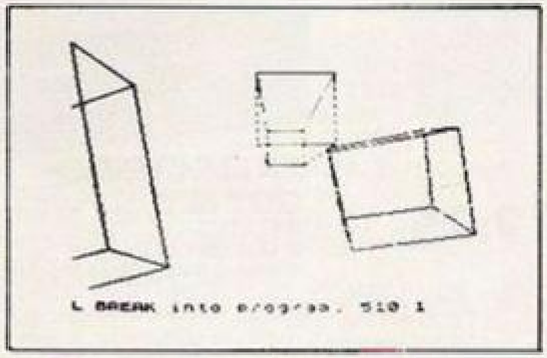
Data is stored as blocks of code at any memory location that you specify. The data should be followed by a blank area which = 12 * (number of sets of data). Therefore the total memory required for any one image = 19 * (number of sets of data). The data itself is made up of three 2's complement numbers and one 1 byte number. A 2's complement number is a 2 byte number where the negative form is 65536−number, e.g., −5 =65536−5 and +5=5: A 2 byte number is Poked into memory as described on page 173 of the Spectrum manual.

The numbers stored are as follows: x co-ordinate, y co-ordinate, z co-ordinate and the 1 byte number 0 to indicate a plot at x, y, z or 1 to draw a line from the last point plotted to x, y, z. I include a Basic program — program A — which will handle conversion of data into a suitable form for the machine-code program. The Basic program will also store the essential parameters such as the pointer to the data, number of sets of data etc., for that figure.

Producing the data for a simple 3D figure is relatively easy. I refer you for further information to my article 3D Rotator of July 1983 and Ian Angell's article BBC 3D Graphics in the February 1984 edition of *Your Computer*.

The 3D program allows the parameters for up to 16 3D images. These parameters are stored in fixed areas from 65032 onwards and in blocks of 20 bytes. Thus the start of the parameter area for figure 4 = 4*20 + 65032 — see table 1.

Each 3D image stored in memory should have a separate set of parameters though they



might share a common set of data. Draws need not point to a memory area after your 3D data but I find I keep track of my memory state better by doing so. For example, fig.0 and fig.1 might both be pyramids and so use the same data. Draws for fig.0 is as normal, after the data, but draws for fig.1 points at another section of free memory and its ADDR points to the fig.0 data.

If it has all seemed rather complicated so far, do not worry — it is really quite easy to use these 3D routines. Here is an example:

To set up fig.0 as a cube first of all work out your data and then store it in data statements in Basic program A. For a cube there are 16 sets of data so adjust line 15 accordingly. The data is going to be stored at 40000 onwards so first of all ensure this area is free from the Basic system with a

CLEAR 39999

and then adjust line 10 accordingly. Finally, this is going to be figure 0 so adjust line 5. Now run program A.

Once the program is complete it will give you a print-out of the next free memory available for data, 40316, and also the position of the parameters area, 65032. If you now wished to have another cube that could move independently of fig.0 then simply make line 10 read

LET ADDR = 40316

Line 5 should read

LET FIG = 1

and run the program again.

This is, of course, an example and actual addresses will depend on the number of sets of data you use. Program A as printed will set up fig.0 as a cube as in the above example.

Now to actually produce a 3D image on the screen there are a number of steps:

- Select the current figure by Poking 64976 with the required figure number 0-15.
- RAND USR 64234 actually converts your data to a list of plots and draws stored in the figure's associated free area of memory, pointed to by Draws.
- RAND USR 64692 produces the 3D image on the screen from the list of plots and draws.
- RAND USR 64679 deletes the last image drawn by the above routine.

Therefore using various sequences of these routines you can produce 3D images from within your Basic programs. As an added feature I have included a machine-code demonstration program which will put the current figure indicated by

PEEK 64976

through its paces. The number of steps, and so speed of this demonstration, can be altered by Poking 63501 with a number between 1 and 150.

The routine is called with

RAND USR 63500

Finally, to alter a given figures position on the screen, distance from you or angle simple alter the 2's complement numbers PX, PY, PZ, Phi, Theta and Psi in the parameters for that figure.

To run a demonstration of the routines from Basic load with program A and then Goto 5000. This sets up three cubes, shows off the machine-code demonstration and then leaves the three cubes to float around in space spinning.

If you remember the 3D Rotator routine in my last article you may be interested to compare it with these new routines. The routine to handle the 3D conversions is written more efficiently, uses 2 byte x, ,y,z co-ordinates and does not draw the figure straight away. This allows a number of figures to be produced

(continued on page 97)

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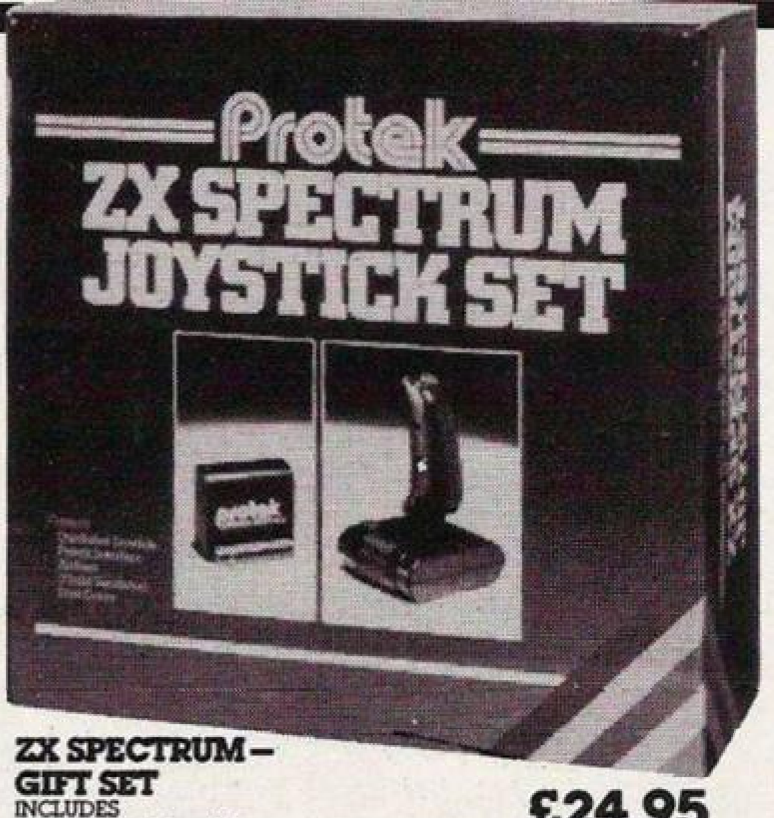

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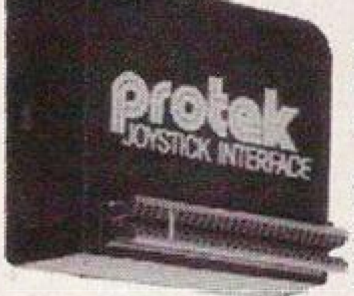

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(continued from page 95)
in memory but not drawn until needed.

This routine also handles calculations for lines partially off screen ensuring that the line eventually produced for the draw routine does not go off screen.

The routines to draw and delete figures use a draw routine specially written for this program which is extremely fast. The routine does not draw a line by plotting but by manipulating screen addresses and rotating a mask.

To use the plot/ routine for yourself use the following method:

- Set up an unused figure e.g., fig 15 by Poking both DrawS and DrawP with the same value, the address of an unused area of memory. Next Poke STFLG with 255.
- Store your plots and draws at this address in the following form:

P,x,y where P = 0 to plot at x,y
P = 1 to draw from the last point plotted to x,y
P = 255 to end the data
x is a normal x co-ordinate
Y has the range 0-191 where 0 is the bottom line of the edit area.
e.g. To draw a frame around the screen the data would be: 0,0,0, 1,255,0, 1,255,191, 1,0,191, 1,0,0, 255

Type program A into your computer and then Save it. Never try to run this program without the 3D machine-code routines in memory. For the 3D routines type in program B and then Save it. Now try running it. If an error is reported correct your error, resave the program and try again. Once the program has run successfully save the code as instructed in line 9999.

You now no longer need program B. You now have a machine-code program saved as code and a Basic program. Do not try and run the machine code without a valid set of parameters and data in memory. To see the various demonstrations load up with the Basic and then the code and then Goto 5000. Or to store an image type Run.

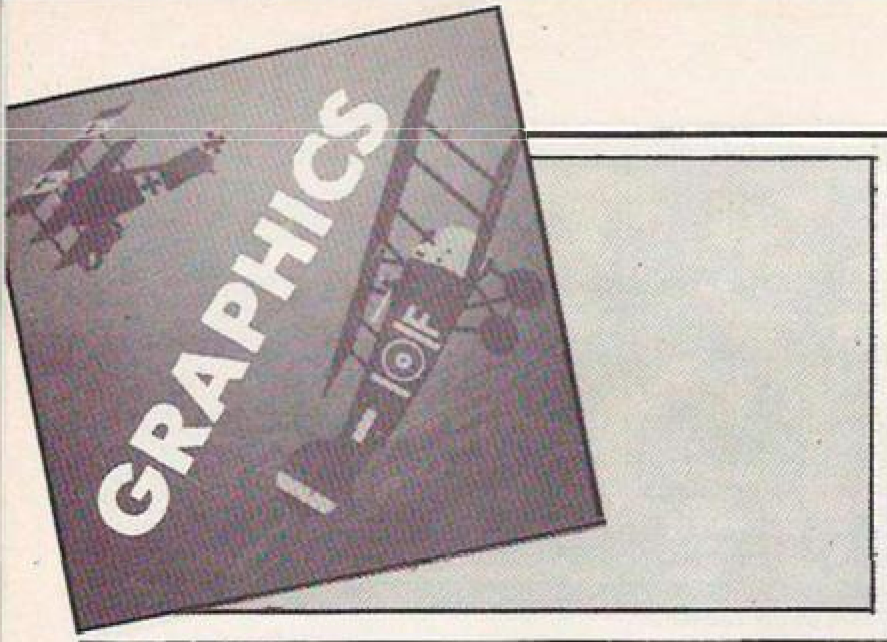
Program A.

```
   1 REM "Data Storage Program"
   2 CLS : CLEAR 39999
   4 REM
   5 LET fig=0: REM "Figure 0-15
"
   9 REM
  10 LET addr=40000: REM "data
storage address"
  14 REM
  15 LET No=16: REM "Number of
sets of data"
  16 GO SUB 17: STOP
  17 LET store=65032+fig*20: POK
E store,No: LET addr1=store+1: L
ET c=addr: GO SUB 500
  18 LET addr1=addr
  20 FOR f=1 TO No
  30 READ x,y,z,P
  40 LET c=x: GO SUB 500
  45 LET c=y: GO SUB 500
  50 LET c=z: GO SUB 500
  55 POKE addr1,P
  60 LET addr1=addr1+1
  75 NEXT f
  80 LET sPare=12*(No+1)
  82 LET free=sPare+addr1
  85 LET c=addr1: LET addr1=stor
e+15: GO SUB 500: LET c=sPare/2+
c: GO SUB 500: POKE addr1,0
  95 PRINT "Data stored for figu
re ";fig
 100 PRINT "data at ";addr
 105 PRINT "next free memory at
";free
 110 PRINT "Parameters at ";stor
e;" to ";store+19
 120 RETURN
 500 IF c<0 THEN  LET c=65536+c
 505 POKE addr1+1,INT (c/256)
 510 POKE addr1,INT (256*(c/256-
INT (c/256)))
 515 LET addr1=addr1+2
 520 RETURN
 999 REM cube data
1000 DATA 20,-20,20,0,20,-20,-20
,1,-20,-20,-20,1,-20,-20,20,1,20
,-20,20,1,20,20,20,1,20,20,-20,1
,-20,20,-20,1,-20,20,20,1,20,20,
20,1,20,-20,-20,0,20,20,-20,1,-2
0,-20,-20,0,-20,20,-20,1,-20,-20
,20,0,-20,20,20,1
4997 REM
4998 REM  Demonstration
4999 REM
5000 RESTORE : LET fig=0: LET ad
dr=40000: LET No=16: GO SUB 17
5010 RESTORE : LET fig=1: LET ad
dr=free: GO SUB 17: RESTORE : LE
T fig=2: LET addr=free: GO SUB 1
7
5011 POKE 63501,10:  CLS : POKE
64976,1: RANDOMIZE USR 63500: PO
KE 64976,0: RANDOMIZE USR 63500:
 POKE 64976,2: RANDOMIZE USR 635
00
5012 FOR f=5  TO 95 STEP 10: POK
E 63501,f: RANDOMIZE USR 63500:
NEXT f
5015 FOR f=65081 TO 65086: POKE
f,0: NEXT f
5016 POKE 63501,10
5019 POKE 65075,40: POKE 65079,2
00: POKE 65036,0: POKE 65056,0:
POKE 65038,0: POKE 65037,0: POKE
 65058,0: POKE 65057,0: POKE 650
39,150: POKEEE 65040,0: POKE 65059
,20: POKE 65060,0
5020 FOR f=170 TO -170 STEP -30:
 LET c=f: LET addr1=65035: GO SU
B 500: LET addr1=65077: GO SUB 5
00: LET c=-f: LET addr1=65055: G
O SUB 500: LET g=ABS (f): POKE 6
5041,g: POKE 65063,g
5025 FOR h=0 TO 2: GO SUB 6000:
NEXT h
5040 NEXT f
5041 RANDOMIZE USR 63500: GO TO
5015
6000 POKE 64976,h: RANDOMIZE USR
 64234: RANDOMIZE USR 64679: RAN
DOMIZE USR 64692: RETURN
```

Program B.

```
  10 DATA "3e0afefa38023efa06004
f21fe00c5e5dde1e5cdd7fae5d5c5edb
0dde5e122d8fd22defd22dcfd22dafd1
1ff00ebed52cb3ccb1dcb3ccb1d22d4f
d22d6fdc1e1d1edb0cdeafacda7fccdb
4fce1c1ed427ccb7f2008fe0020b579b
d38b1fbc9c1c1c9c5ed"
  11 DATA 16344
  20 DATA "4beffdc53ebf9038f2cdb
02247043e010f10fde5d9e1d908e1c1e
d43effd11010178943004ed4416ff477
9953004ed441eff4fb8300969d5d9d1d
9af5f180bb12866841d5d9d1d916006
0781f853803bc3807944fd94b4218044
fd5d9c1cb402829cb78"
  21 DATA 11938
  30 DATA "20153e07a4280325181d2
57dd6206f38167cc6086718102 43e07a
4200a7dc6206f38047cd6086708cb412
80ecb7920060f30072c180407300 12d4
700b6777808d97910a5c9fdcb45862a0
5fe110001ed52ed5bd8fd19cb7cc43df
afd7e452205fe22e5fd"
  31 DATA 91400
  40 DATA "2a01fe2929ed5bd4fd19f
5cd6af9118000cda1f92201fe2a03fe2
929ed5bd6fd19f1fd7745cd6af911570
0cda1f92203fec9cb7cc43dfaeb2ae5f
de5ed52e13801eb444daf08af086f67c
b38cb19200508b9280b08300319ce00e
b29eb18eb08300319ce"
  41 DATA 12206
  50 DATA "00456c67c9ebfdcb45462
80619fdcb4586c9ed52c9e57cb52814c
df9f922f3fde1cd05fa22f1fd21f1fd0
10400c9e13e8032f1fd21f1fd010100c
92adcfdcdb1f911f5fdedb02adefdcdb
1f911f9fdedb02adafdcdb1f911fdfde
db0c9015a0009016801"
  51 DATA 14865
```

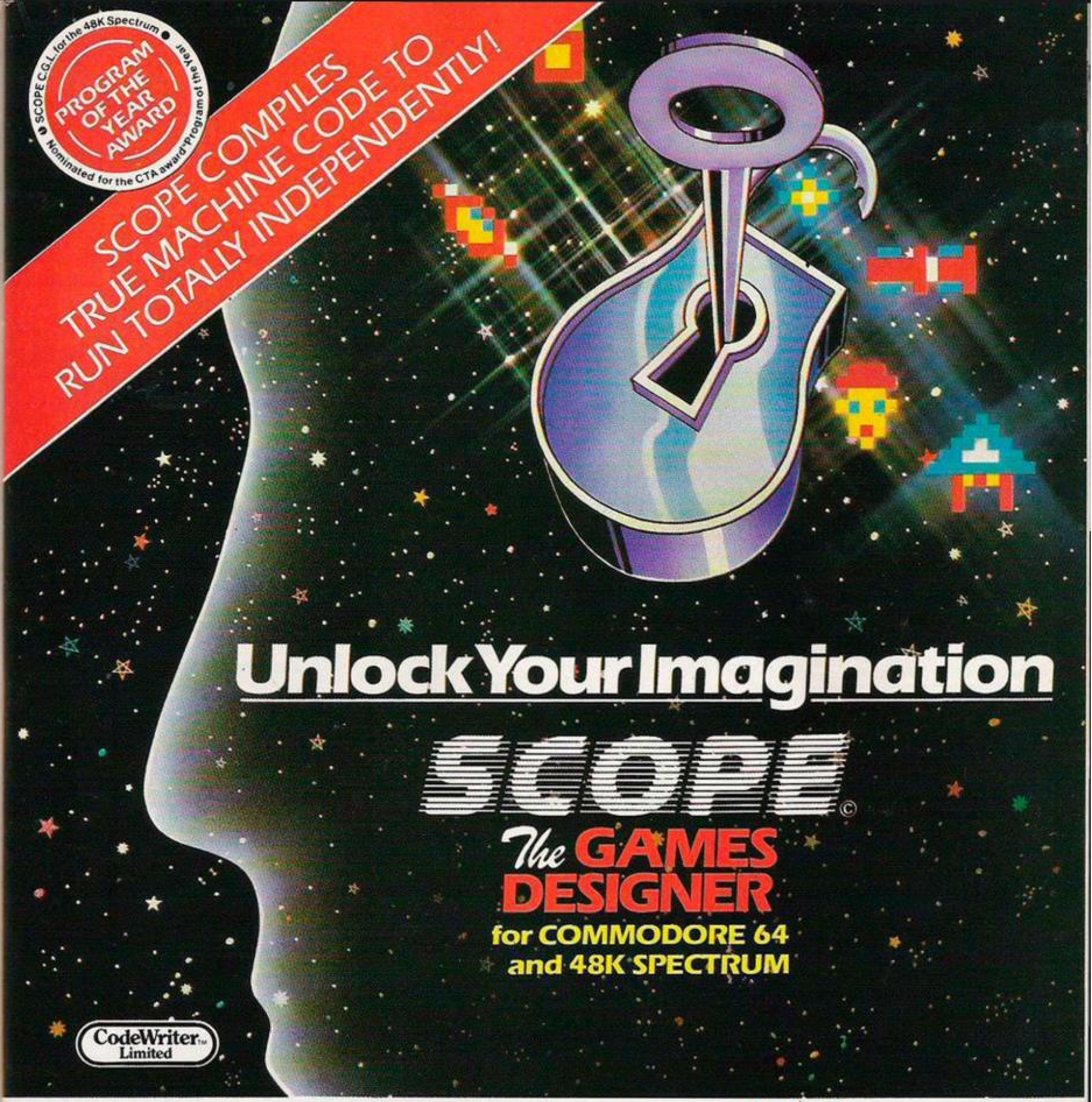
(Program B continued on next page)



(program B continued from previous page)

```
  60 DATA "ed42300109af3c01b400e
d4230023d09011afd0956eb6fc9fdcb4
7462808dd6e03dd7e021806dd6e01dd7
e00260022e5fdfd7745ebcd6af9fdcb4
546c8af575febed52fd3445c9ddcb007
ec0c5cd18fafd3447d1e5cd18fad1fdc
b47462803l9afc9ebed"
  61 DATA 12663
  70 DATA "52afc9dd21f5fded5b01f
eed4b05fefdcb47c6cd47fa2013ed5b0
1fe2201feed4b05fecd47fa2205fe444
ddd21fdfded5b03fefdcb47c6cd47fa2
011ed5b03fe2203feed4b05fecd47fa2
205feed4b03fedd21f9fded5b01fefdc
b47c6cd47fac0ed5b01"
  71 DATA 14664
  80 DATA "fe2201feed4b03fecd47f
a2203fec93ad0fd2108fe11d1fd01140
0a7c8093d20fcc9cdd7faedb03ae4fda
720083eff2b772ae0fd77af3207fecdd
7f9ed5be2fd3ad1fd472ad2fdc5d55e2
356ed5301fe235e2356ed5303fe235e2
356ed5305fe23e5cd67"
  81 DATA 13798
  90 DATA "facd19f9e17e23d1e5f5d
53a07fe4f2a01feed5b03feafb4b2200
73ebfbb3e0030023e013207feb1201b2
2ebfded53edfdc1f102037d02037b020
35950e1c110a23eff12c97ca7280b3ae
cfda72805ac17d29bfc7aa7280d3aeef
da72807aa17d29bfc18"
  91 DATA 12207
 100 DATA "0d7bfec038083aedfdfec
0d29bfce5d5e52aedfda7ed5222e7fdd
12aebfda7ed5222e9fdebed5b03fecde
9fbe5d52aebfded5bedfdcde9fb6322e
9fdd1e1c1ed43edfdc1ed43ebfdc1af0
2033ae9fd02033aeafd0203c35efbd5c
b7c2806cd47fc210000"
 101 DATA 16381
 110 DATA "7ca7280c11ff00a7ed52c
d47fc21ff00e52ae9fded5be7fded53e
9fd22e7fdd1e1d5cb7c2806cd47fc210
0007ca720057dfec0380c11bf00a7ed5
2cd47fc21bf00e52ae9fded5be7fded5
3e9fd22e7fdd1e1c9fdcb4586ed5be7f
dcd8dfc6568ed5be9fd"
 111 DATA 15420
 120 DATA "cd63fcc1d1cda1f9e5c5c
9ebcb7cc487fceb7ab32815010000a7e
d5238030318f91929ed523801036960c
9210000c9d5cd3dfad1c9cb7cc487fce
bcb7cc487fcc373f922ebfded53edfdd
1f1c369fbcdf6fce50e2f06a62ae0fd1
816cdf6fce50e0006b6"
 121 DATA 14795
 130 DATA "2ae2fded5be0fd22e0fde
d53e2fded430ff9d9e5d97e23feff281
24e234623e51f3804ed43effdcd6ef8e
118e8d9e1d9d121e0fd010400edb0c9c
dd7fa010f000911e0fd010500e5edb03
ae4fda7200c2b3eff772ae0fd772ae2f
d77e1c90004080d1116"
 131 DATA 13804
 140 DATA "1a1f23282c3035393d424
64a4f53575b5f64686c7074787c7f838
78b8f92969a9da1a4a7abaeb1b5b8bbb
ec1c4c6c9cccfd1d4d6d9dbdddfe2e4e
6e8e9ebedeef0f2f3f4f6f7f8f9fafbf
cfcfdfefefffffffffffffffffffffff
efefdfcfcfbfaf9f8f7"
 141 DATA 18475
 150 DATA "f6f4f3f2f0eeedebe9e8e
6e4e2dfdddbd9d6d4d1cfccc9c6c4c1b
ebbb8b5b1aeaba7a4a19d9a96928f8b8
783807c7874706c68645f5b57534f4a4
6423d3935302c28231f1a16110d08040
00000"
 151 DATA 10715
4990 CLEAR 59999
5000 LET c=0: LET f=63500
5010 FOR h=1 TO 15: READ a$
5020 FOR s=1 TO LEN a$ STEP 2
5030 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5050 IF a>96 THEN  LET a=a-39
5060 IF b>96 THEN  LET b=b-39
5070 LET a=a-48
5080 LET b=b-48
5090 POKE f,a*16+b
5091 LET c=c+PEEK f
5100 LET f=f+1
5110 NEXT s
5111 PRINT h
5120 READ tot: IF tot<>c THEN  P
RINT "Error at line ";h*10: STOP
5125  LET c=0
5130 NEXT h
5131 REM
9999 CLS : BEEP .2,0: PRINT "COD
E STORED CORRECTLY": PRINT "SAVE
 CODE 63500,1478"
```

■



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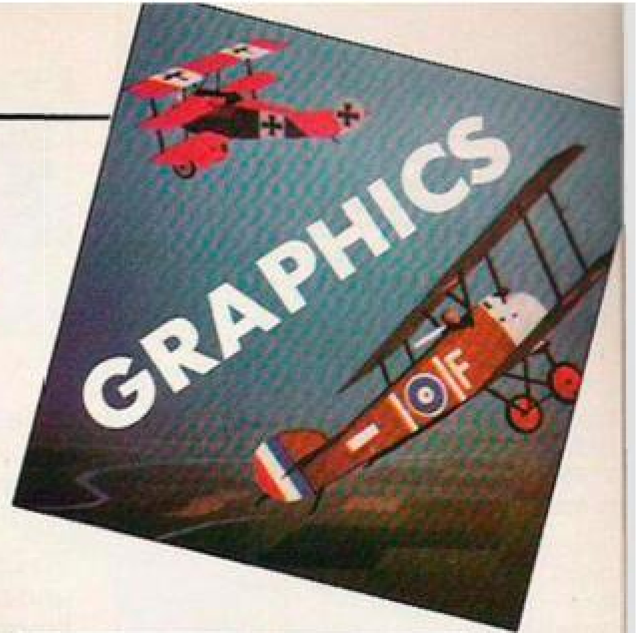


Table 1. The Control codes

CHR$ 0;CHR$ n; Selects a window. n must be in the range 0 to 7.

CHR$ 1;CHR$ tlx;CHR$ tly;CHR$ brx;CHR$ bry. Defines a window's size. Top left x, top left y, bottom right x, bottom right y.

CHR$ 2;CHR$ n; Scrolls. In the window map there are two scrolling registers. This scrolls the current window according to these registers. n is the number of times the operation is to be done.

CHR$ 3;CHR$ n; Scroll window left n times. Preserves the scroll registers.

CHR$ 4;CHR$ n; As above but for right.

CHR$ 5;CHR$ n; As above but for up.

CHR$ 6;CHR$ n; As above but for down. WARNING. CHR$ 6 is the comma in PRINT statements. Any attempt to use PRINT comma will result in a down scroll.

CHR$ 7;CHR$ byte;CHR$ value; Window map poke. There are 45 bytes in a window map, see table 2, numbered 0-44. This enables those bytes to be changed easily.

CHR$ 8; Back cursor.

CHR$ 9; Forward cursor.

CHR$ 10; Down cursor.

CHR$ 11; Up cursor.

CHR$ 12; Delete.

CHR$ 13; Newline.

CHR$ 14;CHR$ routine + mode;CHR$ x;CHR$ y; This is the plot command and is a lot like the Beeb's. See table 3.

CHR$ 15; COPY the whole screen to the ZX printer.

CHR$ 16;CHR$ ink; Define text ink. PRINT INK n; will work but is not temporary.

CHR$ 17;CHR$ paper; As above but for paper.

CHR$ 18;CHR$ flash; As above but for flash.

CHR$ 19;CHR$ bright; As above but for bright.

CHR$ 20;CHR$ over; As above but for OVER.

CHR$ 21;CHR$ inv; As above but for INVERSE.

CHR$ 22;CHR$ x;CHR$ y; Same as PRINT AT y,x but note the x and y are the opposite way around to Sinclair AT control code.

CHR$ 23;CHR$ tab; Changes the current x co-ordinate to "tab".

CHR$ 24;CHR$ oldink;CHR$ newink; Window instant ink change. Changes any oldink into newink.

CHR$ 25;CHR$ oldpaper;CHR$ newpaper; As above but for paper.

CHR$ 26;CHR$ bright; Window actual bright set/reset.

CHR$ 27;CHR$ flash; Window actual flash set/reset.

CHR$ 28;CHR$ width;CHR$ height; Like the CSIZE command on the QL. Defines the width and height of the large characters. See table 2 for more information.

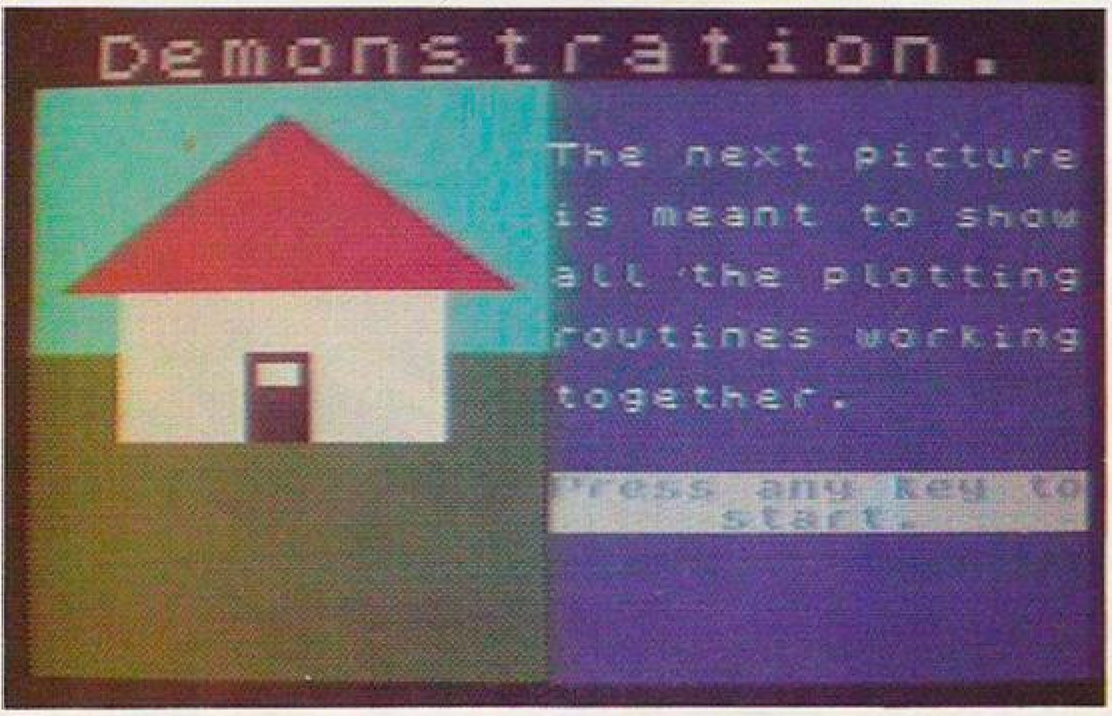
CHR$ 29; In the window map there is an address which tells all the WINDOS routines where the start of the screen is. If this were changed, then any output would not be seen. A Dragon-like invisible screen will be present. So to get the data from the screen memory to the actual display memory, use this command.

CHR$ 30; Home cursor.

CHR$ 31; Clear the current window.

NOTES

There is no graphics windowing. CLS uses the print routine. There is normally a visible cursor.



EVER SINCE THE SPECTRUM was launched, other computers have been brought on to the market with better graphics capabilities.

So, feeling that the Spectrum could do with some added graphical muscle, armed with my 48K Spectrum with Microdrive and Hisoft's excellent Devpac, a highly recommended package, I set out to give the Spectrum all these facilities and more. The result is Windos, a 5K program packed with practically every feature you could wish for. A whole book could be written describing all the possibilities, but the main functions are:

- 32- or 64-column windowing.
- Four-way window scrolling.
- An extended plot function.
- Instant colour changes.
- Large letters in any of four orientations.
- An intelligent paint/unpaint.
- An alternative screen at any address.

To get Windos up and running, type in listing 1 and Save it a few times, then Run it. Once Run successfully, the code will be automatically saved.

Owners of Microdrives may wish to change the appropriate lines to enable saving to cartridge.

Most experienced Spectrum users will be familiar with the concept of streams and channels. What I have done is to alter the channel 3 output routine vector, found in the channel information area, and make it point to my own output routine.

This means that the ZX Printer is now disabled.

LPRINTs,OPEN # 2,"p"

can be used to enable Print. However, how can this be of any use for accessing the routines? BBC users are used to the VDU statement on their micro, but this can be replaced by:

PRINT CHR$ n;CHR$ n; etc

to achieve the same effect. Well, this is exactly how the routines are accessed, via control codes. Of course, most of the codes are different from the BBC's and have a different number of parameters — see table 1 for a complete run-down. Now back to the original

(continued on page 103)

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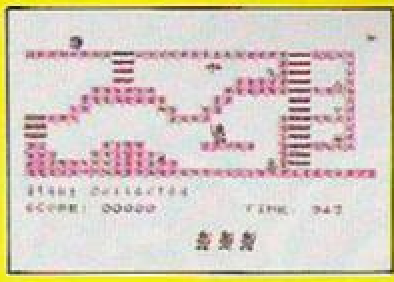
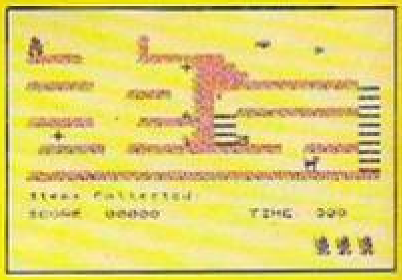

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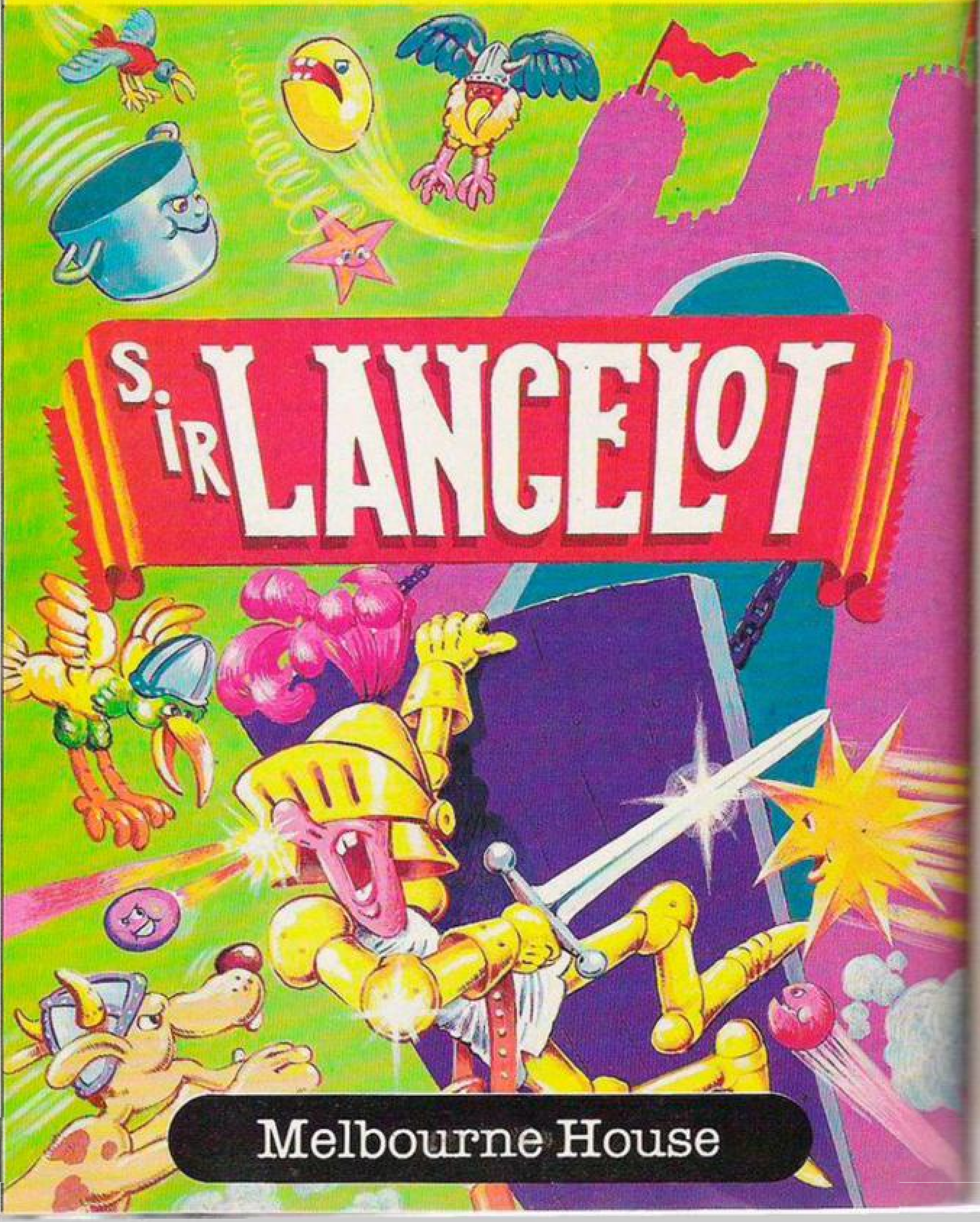
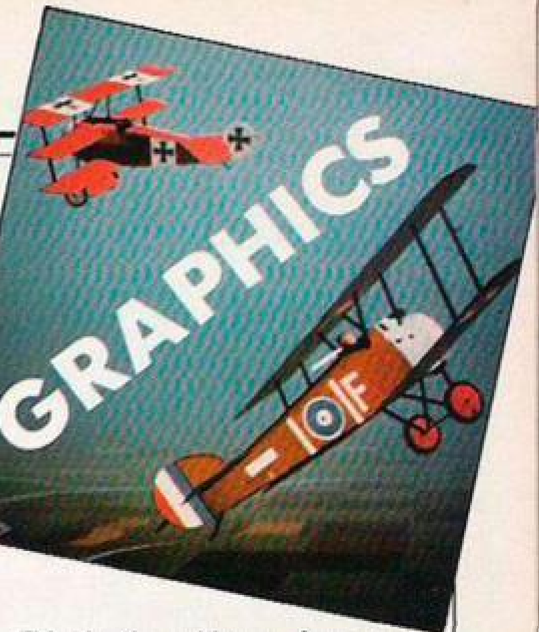


(continued from page 101)

Table 2. The window map.

Byte	Meaning.
0-3	The window size as set up and in the same order as CHR$ 1; etc.
4	The text colour.
5	The graphics colour.
6-7	The text co-ordinates, with 0,0 being at the top left of the window, NOT the screen.
8-9	The last x,y specified by CHR$ 14;
10-11	Used internally.
12	Text flags. See table 4.
13	Graphics flags. See table 5.
14	The attribute used by the cursor, so the cursor can be flashing or not.
15-29	The parameter queue. See next month's article for more details.
30	Current control code.
31-32	Next free space in queue, as an address.
33	Number of parameters to come before execution.
34	Width of large characters.
35	Height of large characters.
36-37	Second to last point specified by CHR$ 14;.
38	Draw pattern. Like the Oric PATTERN command. This is the bit pattern that draw uses to do dotted lines. Normally 255 for solid lines.
39	Text attribute mask. As there is no eg. PAPER 8 allowed, this is used to achieve the same effect. Every bit of this byte that is set means that the equivalent bit of *the old attribute to be obliterated* by printing will not be destroyed. So to achieve INK 8 set this byte to 7, PAPER 8 is BIN 111000 etc.
40	As above but for graphics.
41	The pixel scroll register.
42	As above but for the attributes.
43-44	This is the address of screen memory. Normally 16384, but can be changed. Normal Intel format applies, ie. LSB first followed by the MSB.



(continued on page 107)

Listing 1.

```
  10 REM
  20 REM Loader for WINDOS.
  30 REM Written by Ian Briscoe.
  40 REM August 1984.
  50 REM
  60
  70 CLEAR 59999
  80 LET line=1000
  90 RESTORE 1000
 100 LET address=60000
 110 GO SUB 500
 115 LET address=60417
 120 FOR a=1 TO 98
 130   GO SUB 500
 140 NEXT a
 150 CLS
 180 PRINT "Code in memory."
 190 PRINT "Insert free tape...press any keyto start..."
 200 PAUSE 0: PRINT "SAVEing ""LOADER1"""
 205 SAVE "LOADER1"
 210 PRINT "Again ? (Y/N) "
 220 LET a=CODE INKEY$
 230 IF a=89 OR a=121 THEN GO TO 170
 240 IF a<>78 AND a<>110 THEN GO TO 220
 250 PRINT "Insert free tape...press any keyto start..."
 260 PAUSE 0: PRINT "SAVEing ""WINDOS"" CODE 60000,5282"
 270 SAVE "WINDOS"CODE 60000,5282
 280 PRINT "Again ? (Y/N) "
 290 LET a=CODE INKEY$
 300 IF a=89 OR a=121 THEN GO TO 250
 310 IF a<>78 AND a<>110 THEN GO TO 290
 320 PRINT "Finished.": STOP
 500 REM
 510 REM Reader and poker.
 520 REM
 530
 540 READ a$,checksum
 550 LET total=0
 560 FOR i=1 TO LEN a$ STEP 2
 570   LET high=CODE a$(i)-48
 580   LET low=CODE a$(i+1)-48
 590   LET high=high-39*(high>9)
 600   LET low=low-39*(low>9)
 610   LET byte=(16*high)+low
 620   LET total=total+byte
 630   POKE address,byte
 632   LET address=address+1
 634 NEXT i
 640 IF total<>checksum THEN PRINT "Error in line ";line;".": "Check and re-run.": STOP
 645 PRINT line;" OK,";
 650 LET line=line+10
 660 RETURN
 670
1000 DATA "c301e[illegible]",3[illegible]
[illegible]
```

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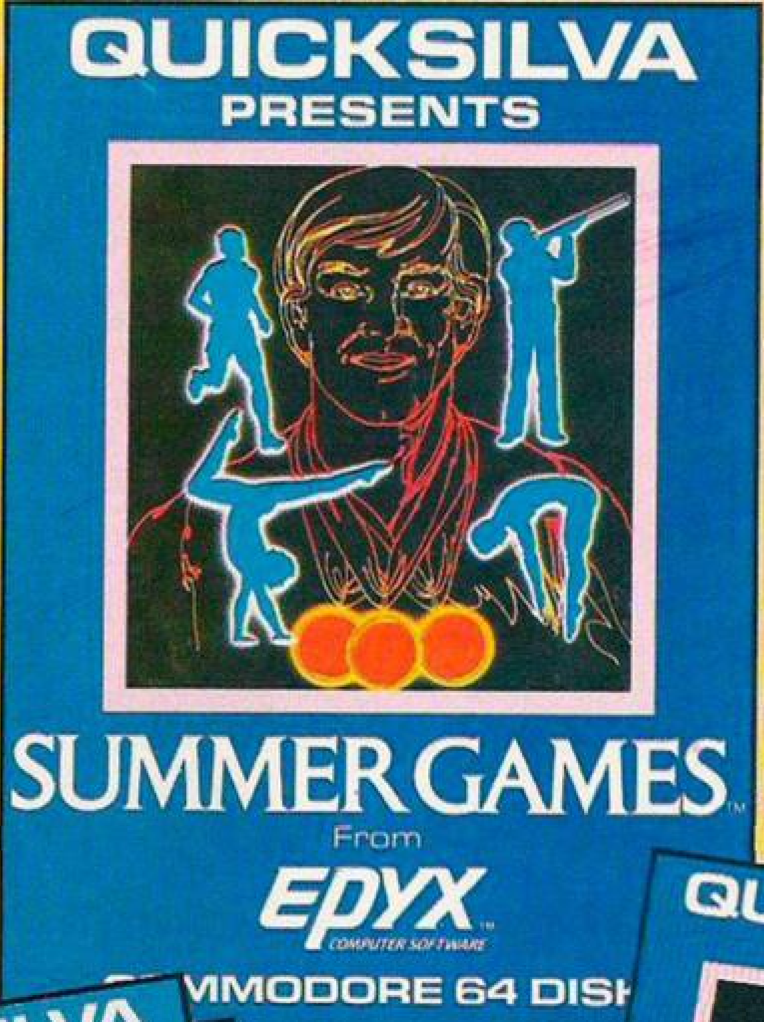

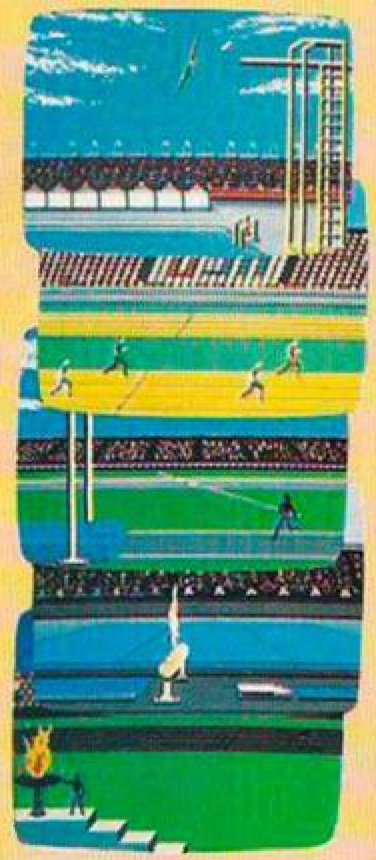

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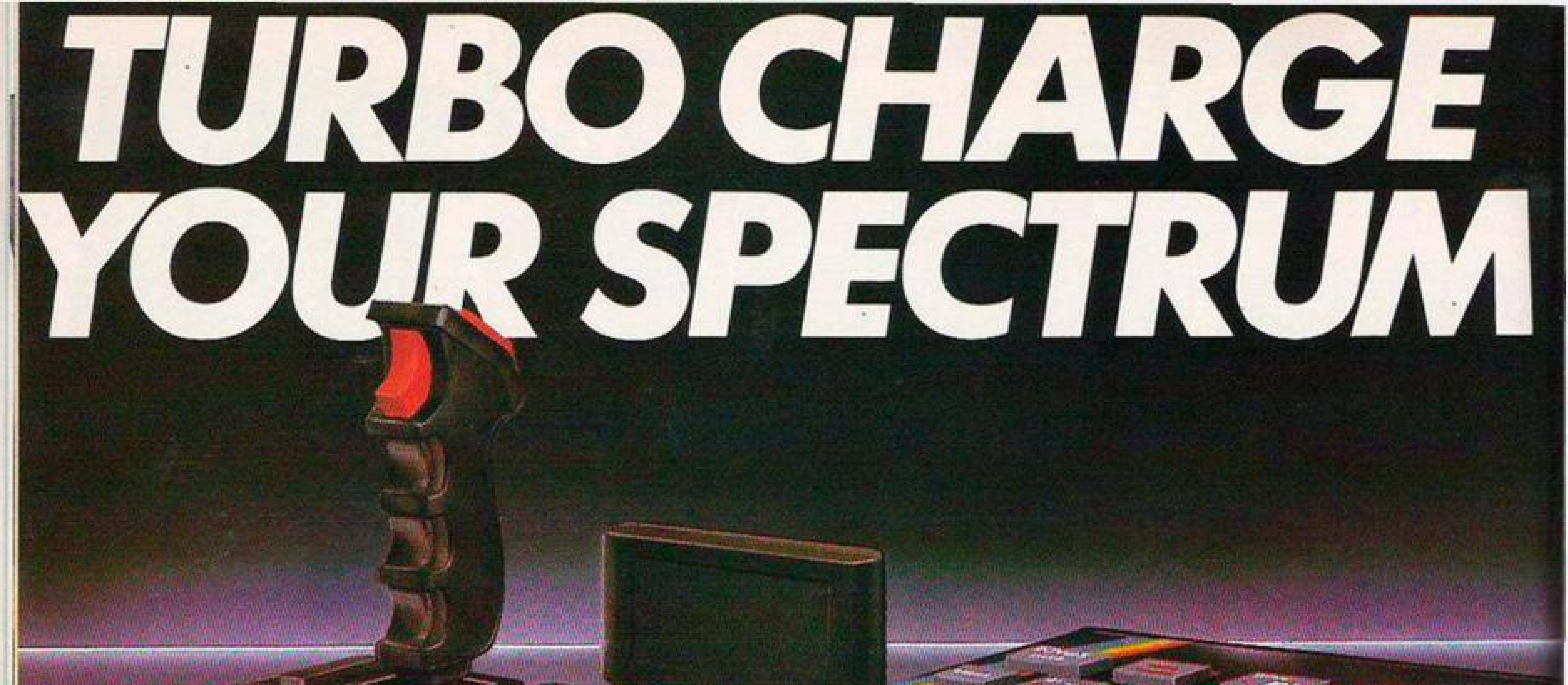

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(continued from page 103)

question. To get Windos into operation, first initialise channel 3 by using

RANDOMIZE USR 60000

However, this won't clear the system's own variables area which holds the attributes for all 8 windows, each "window map" as I call them, being 45 bytes long, so use

RANDOMIZE USR 60003

to initialise it. More information about the window map can be found in table 2.

Now you can begin to use the system. Type in the demonstration program to see some of the many effects possible.

Once fully understood, I hope that you will begin to realise the possibilities the system offers. Next month, I will explain how the system works inside.

The last part of the series will give Interface 1 owners an Extended Basic to use the system neatly. A tape is available with all the programs included. Send a cheque for £3.50 to Ian Briscoe, 32 York Road, Maidstone, Kent ME15 7QY.

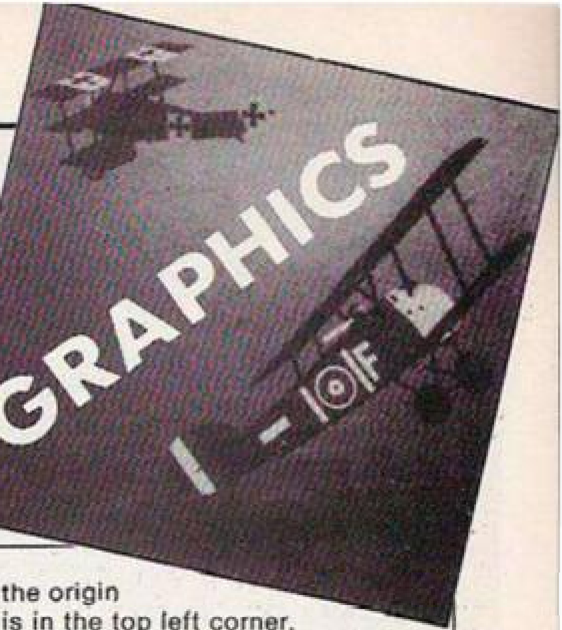

Table 3. The plotting routines and modes.

When using the plot command, CHR$ 14, the first parameter is the routine added to the plotting mode. They are as follows:

Plotting modes.

0 = Normal OR plotting.
1 = XOR or OVER plotting.
2 = UNPLOT.
3 = MOVE.

Plotting routines

0 = PLOT. An ordinary dot plot.
4 = DRAW. Draw a line to x,y. Note that the origin is in the top left corner.
8 = PAINT. Fill in enclosed area. This is an intelligent fill so make sure there is at least 0.5K between Ramtop and your program as the machine stack is used as workspace.
12 = BOX. Draws a triangle using the last and the second to last points plotted as two of the three points, the third being the point specified.
16 = TRIANGLE. Draws a triangle using the last and the second to last points plotted as two of the three points, the third being the point specified.
20 = FILLED BOX. Like BOX only filled. Like the other shape routines, the draw routine is used so if a draw pattern, see table 2, byte 38, is in use then there will be a textured box.
24 = SET. Just sets the plotting mode and the graphics co-ordinates.

Table 4. The text flags.

Bit. Meaning.

0-1 00 = Normal over printing.
01 = XOR or OVER 1 printing.
10 = Inverse printing.
11 = OR printing.

2 Scrolling suppression.
0 = Normal scrolling when the cursor tries to go too far up, or too far down.
1=A Lynx-type wraparound window.

3 Attribute suppression.
0 = Old attributed destroyed.
1 = Old attribute left unchanged.

4 'Form feed' suppression.
0 = Normal newline.
1 = Cursor stays on the same line.

5 Output selection.
0 = Normal 32 or 64 column windowing.
1 = Large letters. To print large letters, this bit must be set.

6 32/64 column selection.
0 = 32 column windows and printing.
1 = 64 column windows and printing.

7 Cursor switch.
0 = Cursor on.
1 = Cursor off.

It is useful when working at bit level to use the BIN functions.

```
  10 REM
  20 REM WINDOS Demonstration
  21 REM written by Ian Briscoe
  22 REM August 1984
  30 REM
  40
  45 CLEAR 59999
  50 GO SUB 1000
  60 GO SUB text1
  70 GO SUB picture1
  80 GO SUB text2
  90 GO SUB picture2
 110 GO SUB end
 120 STOP
 130
1000 REM
1010 REM Initialisation.
1015 REM
1016
1020 LET text1=2000
1030 LET text2=4000
1040 LET picture1=3000
1050 LET picture2=5000
1052 LET end=6000
1054 LET codes=7000
1056 LET strings=8000
1057 LET load=9000
1058 POKE 23693,71: BORDER 0: CL
S
1060 INPUT "Have you got WINDOS
in memory? "; LINE a$
1070 IF a$="y" OR a$="Y" THEN GO
 TO 1090
1080 GO SUB load
1090 RANDOMIZE USR 60000
1100 RANDOMIZE USR 60003
1110 OPEN #2,"p"
1120 RESTORE 1900
1130 GO SUB codes
1180 PRINT " Demonstration."
1190 FOR a=1 TO 5
1200    FOR b=7 TO 1 STEP -1
1210       PRINT CHR$ 24;CHR$ b;C
HR$ (b-1);
1215       PAUSE 2
1220    NEXT b
1230    PRINT CHR$ 24;CHR$ 0;CHR$
 7;
1240 NEXT a
1250 RETURN
1260
1900 REM Define length of data
for subroutine.
1901 DATA 48
1902 REM Select window 0
1903 DATA 0,0
1906 REM Define 64 column mode
1907 DATA 7,12,192
1908 REM Define ink and paper.
1909 DATA 16,7,17,1
1912 REM Define window 0
1915 DATA 1,0,2,31,21
1918 REM Select window 1
1921 DATA 0,1
1930 REM Define 32 col. mode.
1933 DATA 7,12,128
1936 REM Define text colour.
1939 DATA 16,7,17,5
1942 REM Define window (32 col)
1945 DATA 1,16,2,31,21
1948 REM Select window 2
1951 DATA 0,2
1954 REM Large letters mode.
1957 DATA 7,12,160
1960 REM Define colours.
1963 DATA 16,7,17,0,7,5,7
1966 REM Define window 2.
1969 DATA 1,0,0,31,1
1972 REM Define letter size.
1975 DATA 28,2,2
1976
2000 REM
2010 REM Text routine 1.
2020 REM
2030
2040 RESTORE 2900
2060 GO SUB strings
2110 RETURN
2905 REM Number of strings.
2907 DATA 9
2909 REM Text
2911 DATA CHR$ 0+CHR$ 0+CHR$ 31
2912 DATA "    This is a small de
monstration"+CHR$ 13
2914 DATA "of what is possible w
ith the new"+CHR$ 13
2916 DATA "output routine."+CHR$
 13+CHR$ 13
2918 DATA "    To start  with a p
icture of a"+CHR$ 13
2920 DATA "little house to  demo
nstrate how"+CHR$ 13
2922 DATA "complicated pictures
can be made"+CHR$ 13
2924 DATA "with a few well chose
n commands."+CHR$ 13
2925 REM Set scrolling registers
      and scroll 32 times.
2926 DATA CHR$ 7+CHR$ 41+CHR$ BI
N 110110+CHR$ 7+CHR$ 42+CHR$ BIN
 110110+CHR$ 2+CHR$ 32
2928
3000 REM
3010 REM Picture 1.
3020 REM
3030
3040 RESTORE 3900
3050 GO SUB codes
3100 RETURN
3110
3900 REM Length of data.
3902 DATA 83
3904 REM Select window 1.
3906 DATA 0,1
3908 REM Define graphics colour
3910 DATA 7,5,BIN 100
3912 REM Move to 128,88
3914 DATA 14,3,128,88
3916 REM Set the draw pattern.
3918 DATA 7,38,BIN 10101010
3920 REM Draw a filled box to
      254,175
3922 DATA 14,20,254,175
3924 REM Reset draw pattern.
3926 DATA 7,38,255
3928 REM Change colour.
3930 DATA 7,5,BIN 01111000
3932 REM Move to 152,64
3934 DATA 14,3,152,64
3936 REM Unfill a box to
      231,111
3938 DATA 14,22,231,111
3939 REM Move to 184,88
3940 DATA 14,3,184,88
3941 REM Draw a line box to
      199,111
3942 DATA 14,12,199,111
3943 REM Move to 186,90
3944 DATA 14,3,186,90
3945 REM Draw a line box to
      197,97
3946 DATA 14,12,197,97
3947 REM Fill the door.
3948 DATA 14,8,198,98
3949 REM Set graphics mask and
      colour
3950 REM This does PAPER 8,INK 2
3951 DATA 7,10,56,7,5,2
3952 REM Move to 136,71
3953 DATA 14,3,136,71
3954 REM Move to 247,71
3955 DATA 14,3,247,71
3956 REM Draw the roof,a
      triangle at 192,24.
3957 DATA 14,16,192,24
3958 REM Fill the triangle.
3959 DATA 14,8,192,50
3960 REM Set the scrolling
      registers.
3961 DATA 7,41,BIN 110100,7,42,B
IN 110100
3962 REM Scroll 240 times.
3963 DATA 2,240
3964 REM Select window 0
3965 DATA 0,0
3966 REM Clear screen
3967 DATA 31
4000 REM
4010 REM Text 2.
4020 REM
4030
4040 RESTORE 4800
4090 GO SUB strings
4100 RETURN
4110
4800 REM Number of strings.
4801 DATA 13
4804 REM Scroll picture into
      window 0.
4805 DATA CHR$ 0+CHR$ 3+CHR$ 7+C
HR$ 1+CHR$ 2+CHR$ 7+CHR$ 41+CHR$
 BIN 110110+CHR$ 7+CHR$ 42+CHR$
BIN 110110
4806 DATA CHR$ 2+CHR$ 16
4808 REM Select window 1.
4810 DATA CHR$ 0+CHR$ 1
4812 REM Define the colour.
4814 DATA CHR$ 7+CHR$ 4+CHR$ 79
4816 REM Clear window.
4818 DATA CHR$ 31+CHR$ 10
4820 REM Start printing.
4821 DATA ""
4822 DATA "The next picture"+CHR
$ 13
4824 DATA "is meant to show"+CHR
$ 13
4826 DATA "all the plotting"+CHR
$ 13
4828 DATA "routines working"+CHR
$ 13
4830 DATA "together."+CHR$ 13
4832 DATA CHR$ 13+CHR$ 13+CHR$ 7
+CHR$ 4+CHR$ BIN 11001111
4834 DATA "Press any key to"+"
   start."
5000 REM
5010 REM Picture 2.
5020 REM
5030
5040 PAUSE 0
5050 RESTORE 5800
5060 GO SUB codes
5110 PRINT " Press any key.";
5120 RETURN
5130
5800 REM Length
5802 DATA 103
5804 REM Select window 3 and
      define it.
5806 DATA 0,3,7,4,86,1,0,2,31,23
5808 REM Define graphics colour,
      and attribute mask.
5810 DATA 7,5,86,7,40,BIN 111110
00
5812 REM Start drawing.Follow
      the steps through to see
      how each effect is made.
5814 DATA 14,3,10,17
5816 DATA 7,38,BIN 11001100
5818 DATA 14,20,79,100
5819 DATA 7,38,255
5820 DATA 14,3,150,25
5822 DATA 14,3,250,50
5824 DATA 14,16,100,75
5826 DATA 14,8,200,50
5828 DATA 14,3,110,110
5830 DATA 7,38,BIN 10101010
5832 DATA 14,12,255,180
5834 DATA 14,3,1,16,7,38,BIN 111
10000
5836 DATA 14,21,255,191
5838 DATA 7,38,BIN 00001111
5840 DATA 14,3,1,16,14,21,255,19
1
5842 DATA 7,38,255
5844 DATA 14,3,0,16,14,22,255,19
1
5845 REM Set up the large
      letters mode,size,direction
      and position.
5846 DATA 7,12,160,28,2,10,7,13
0,14,24,0,48
6000 REM
6010 REM End.
6020 REM
6030
6035 PAUSE 0
6040 PRINT PAPER 0; INK 6;CHR$ 3
1;
6042 PRINT CHR$ 28;CHR$ 1;CHR$ 2
;
6043 LET int=0
6045 PRINT CHR$ 7;CHR$ 13;CHR$ 0
;CHR$ 14;CHR$ 24;CHR$ 128;CHR$ 9
6;CHR$ 7;CHR$ 5;CHR$ 1;"THE END"
6046 PRINT CHR$ 7;CHR$ 13;CHR$ 4
;CHR$ 14;CHR$ 24;CHR$ 127;CHR$ 9
5;CHR$ 7;CHR$ 5;CHR$ 5;"THE END"
6047 PRINT CHR$ 7;CHR$ 13;CHR$ 8
;CHR$ 14;CHR$ 24;CHR$ 128;CHR$ 9
5;CHR$ 7;CHR$ 5;CHR$ 7;"THE END"
6048 PRINT CHR$ 7;CHR$ 13;CHR$ 1
2;CHR$ 14;CHR$ 24;CHR$ 127;CHR$
96;CHR$ 7;CHR$ 5;CHR$ 3;"THE END
"
6049 FOR b=1 TO 30
6050    FOR a=1 TO 7 STEP 2
6055       PRINT CHR$ 24;CHR$ a;C
HR$ (a+1);
6060    NEXT a
6070    FOR a=0 TO 6 STEP 2
6075       PRINT CHR$ 24;CHR$ a;C
HR$ (a+1);
6080    NEXT a
6090 NEXT b
6100 RETURN
6110
7000 REM
7002 REM Code printing.
7004 REM
7009 READ length
7010 FOR a=1 TO length
7020    READ data
7030    PRINT CHR$ data;
7040 NEXT a
7050 RETURN
7060
8000 REM
8002 REM String printing.
8004 REM
8005
8006 READ length
8008 FOR a=1 TO length
8010    READ a$
8012    PRINT a$;
8014 NEXT a
8016 RETURN
8018
9000 REM
9010 REM Load in WINDOS.
9020 REM
9030
9045 INPUT "Have you got a Micro
drive ? "; LINE a$
9050 LET a=CODE a$: IF a=89 OR a
=121 THEN GO TO 9070
9060 LOAD "WINDOS"CODE
9065 RETURN
9070 LOAD *"m";1;"WINDOS"CODE
9080 RETURN
```

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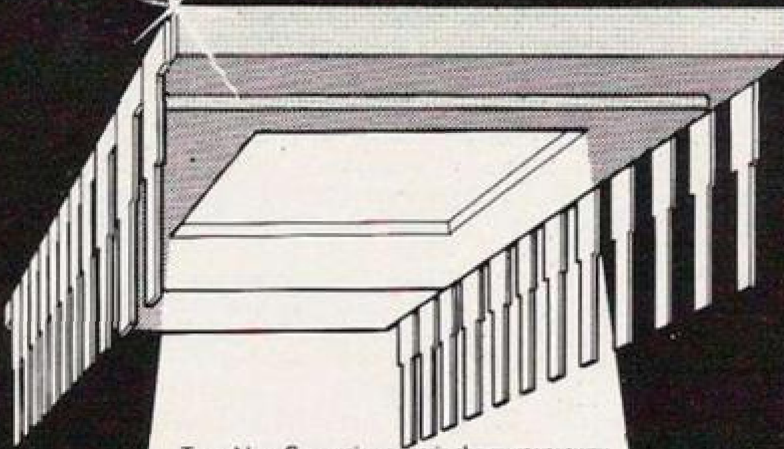

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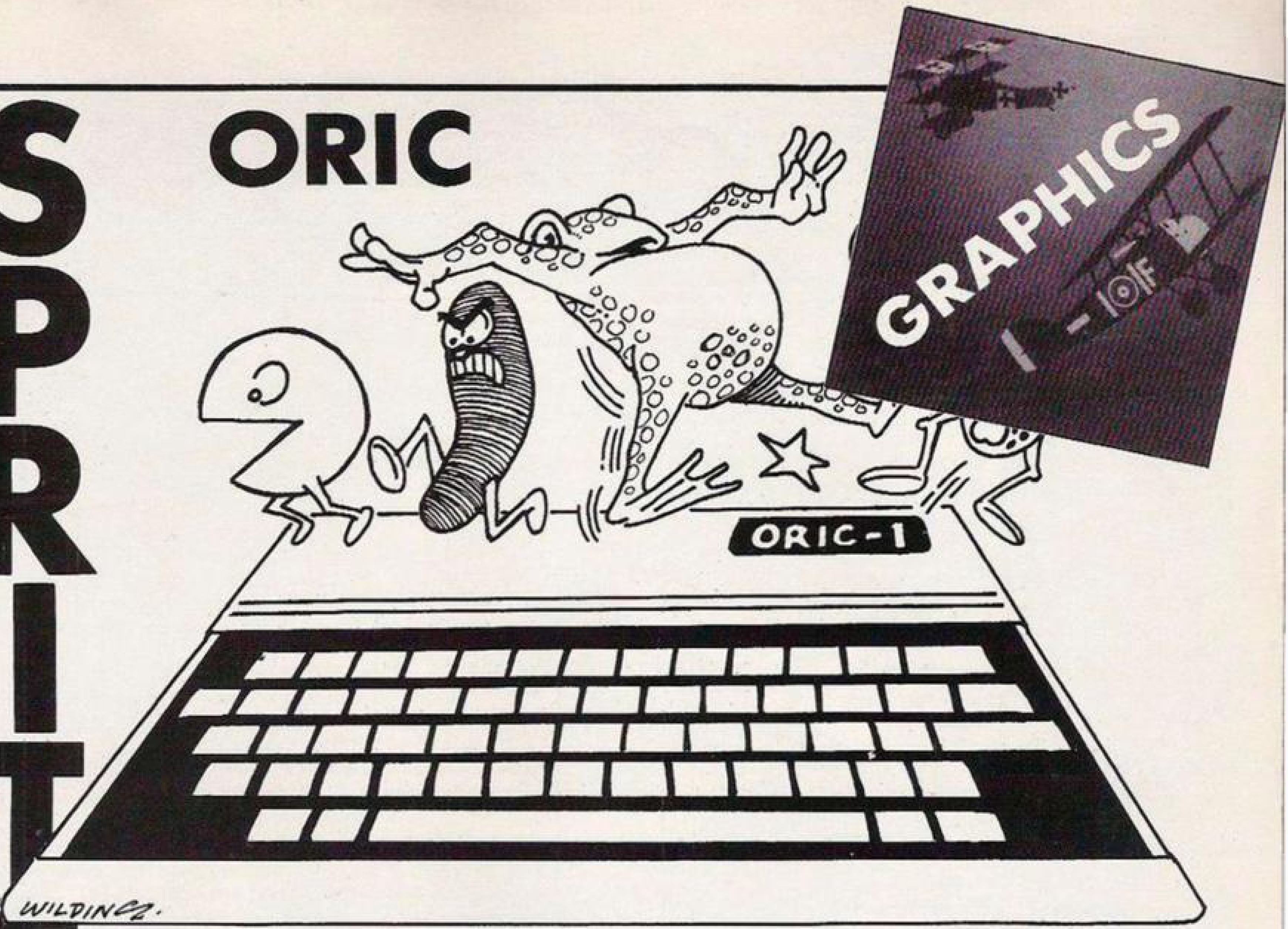


Mattias Gyllerup with a short sprites program together with a demonstration of what it can do.

THIS IS A sprite program for the Oric-1 48K, but I believe that it would suit the Atmos as well. The Temo — Test Mode — sprites will only work in Text mode, but still give you the effect of one pixel movement in every direction. Each sprite is made by a 6×8 grid — one character — but needs a 12×24 grid — four characters — to work, eg. One sprite would easily fit into the character C, but to work it must also use D,E and F. This technique consumes a lot of memory, but it is the only way it can be done.

Line 0 to 300 is a demo program with only one sprite in action. The description of how to use the sprites will refer to this program.

Line 500 to 870 shows you 20 sprites in action. Run 500 will allow you to look at this small demo program. To get back to the ordinary character set, press the Reset button.

Line 60000-60450 is the Temo machine code. When you are about to make your own program using sprites then only type in these lines, and then type in your program, which must — of course — contain a Gosub to 60000.

Remember that the Gosub must be after your Data statements, if you use any.

To control the sprites in the Temo program you have got to know a few things first.

- If the sprite is on (1) or off (0) — ON/OFF status
- The Y and X coordinates of the sprite — YPOS & XPOS status.
- The address to the first character in your sprite eg. If you choose the characters A,B,C,D to represent your sprite, then the address to the first byte of "A" is important — ASCII pointer status.
- The ASCIIcode of the first character in your sprite. If you choose same as above, then the ASCIIcode of "A" is important — ASCIIcode status.
- The address to the first byte of your defined sprite — Spritepointer status.

THE ADDRESSES TO THE STATUSAREA

Status name	Basic address	Uses
ON/OFF	38912-39011	1 byte
YPOS	39012-39112	1 byte
XPOS	39112-39211	1 byte
ASCIIPOINTER	39212-39311	2 bytes
SPRITEPOINTER	39712-39811	2 bytes
ASCIICODE	39812-39911	1 byte

Although some status only uses 1 byte to store their content, they are made of 2 bytes. But it's only the low byte that is poked. And at last, a very important address: *105*. This address indicates how many sprites, from the first sprite, that you use. The value 2 means the first 2 sprites, 15 means the first 15 sprites.

You can have a value between 1 and 49. Zero or greater than 49, will turn the program off.

This makes it possible for you to store 49 sprite statuses. But because of the character limitation — only 92 useable characters divided by four, makes a total of 23 sprites — the sprite number will decrease. But if you are a whizkid, then perhaps you could learn how to make use of the other 26 possible sprites.

Now let's start to write.

■ The first line that does anything in your program will look like this:

```
0 HIMEM 38900
```

This line prevents the Temo program and the status area to be overwritten by the Oric variable area.

■ Before creating the status area, we must clear it.

```
10 FOR F=38912 TO 40011
20 POKE F,0
30 NEXT F
```

■ Now let's choose the sprites to work with. I choose to work only with sprite 5. Don't bother about the number, I just chose it.

```
40 N=5
50 POKE 105,N
```

I have to poke address 105 with N(5) only because the program have to run through the five first sprites to find my sprite. As you can see, it would be faster if I had chosen sprite 1, but this is just a demo to show you the main routines.

■ Now we must define the sprite, and place it somewhere in the memory. I decided to place it at address 38892-38899. I could have placed it anywhere else. But now I see a problem. I have to decrease the Himem, so that the sprite codes won't be overwritten by the variable area. So I change row 0 to:

```
0 HIMEM 38892
```

■ And to define the sprite and place it at memory location 38892-38899.

```
60 FOR F=38892 TO 38899
70 READ A
80 POKE F,A
90 NEXT F
100 DATA 18,12,30,45,45,30,18,0
```

The Data values are taken from the Oric manual page 89. As you can see, the sprite has

(continued on next page)

(continued from previous page)

the same size as an ordinary character. But it takes four characters to poke the sprite onto screen. So on every characterised sprite, Temo will use four character. That's why the total amount of sprites, only is 23. I know that it's a waste of memory, but it's the only way to get a four-way direction of the sprites.

■ To get the status address of sprite N, then use the following formula: Status Basic address + N × 2 − 2 = status address to sprite N. For example, we use sprite number 5, and want to know the address to On/Off status. The On/Off status Basic address is 38912. See "The addresses to the status area". 38912 + 5 × 2 − 2 = 38920. 38920 is the On/Off status address of sprite number 5. Let's set the status.

■ The On/Off status. The value 1 turns sprite on, value 0 turns sprite off:

110 POKE 38912 + N × 2 − 2,1

■ The YPOS status:

120 POKE 39012 + N × 2 − 2,15

■ The XPOS status:

130 POKE 39112 + N × 2 − 2,15

We now have positioned the sprite at 15,15.

■ The ASCIIPointer status:

140 DOKE 39212 + N × 2 − 2,
46080 + (8 × ASC("a"))

To receive the Doke value, we use another formula, found on page 85 in the Oric manual. The character is the first character that the sprite is made. I have chosen the character a,b,c and d to be used in my sprite. If you would like to use other characters then simply change the character between the quotationmarks. For example, if you would like to use the character T,U,V and W then change the line to:

140 DOKE 39212 + N × 2 − 2,
46080 + (8 × ASC("T"))

■ The sprite pointer status:

150 DOKE 39712 + N × 2 − 2,38892

The value 38892 is the address to the first byte of the sprite codes.

■ The ASCIIcode status:

160 POKE 39812 + N × 2 − 2,ASC("a")

The ASCIIcode of your first character. The character used here must be the same as in line 140. Remember: Try not to use the four characters, preserved for one sprite, in another sprite. It wouldn't look too good. Now all status have been taken care of.

■ Type:

170 DOKE # 2F5,40396

This operation defines a new command for the Oric. The Temo command.

180 !

! is the new command. See page 128 in the Oric manual. Now all necessities have been taken care of, so let's make a little routine to see what can be done with the Temo program.

190 FOR F = 1 to 20
200 Y = PEEK(39012 + N × 2 − 2,Y)
210 Y = Y + 1
220 POKE 39012 + N × 2 − 2,Y
230 X = PEEK(39112 + N × 2 − 2)
240 X = X + 1
250 POKE 39112 + N × 2 − 2,X
260 !
270 NEXT F

This little routine moves the sprite around the screen. Experiment with different values to add in line 210 and 240.

280 POKE 38912 + N × 2 − 2,0

Turn sprite off.

290 !

Makes the sprite disappear.

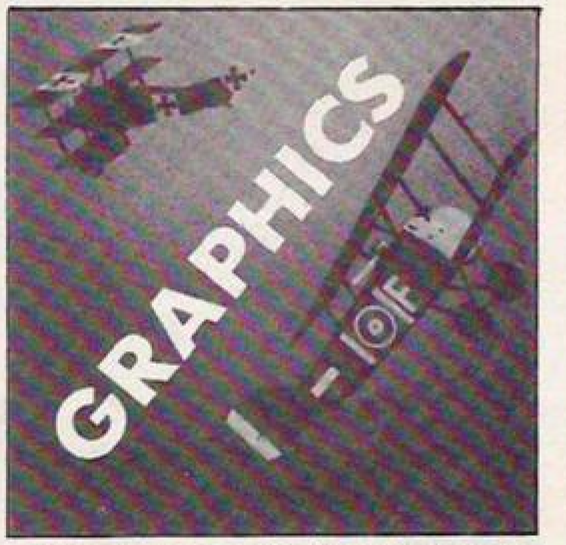
300 END

Don't clear the screen, if you don't want to miss the effect. Run, and watch the upper left corner of the screen. This program was written only for one sprite. Now it's your turn to make use of the Temo sprites.

Study the program, and see how it's done. After a while you will have all addresses in your head, and then the use of the Temo sprites will be easier.

I hope that you understand, that the more sprites you use, the more Poking and Doking will have to be done.

To prevent a system crash the first line to be written in any of your programs is: line number Himem 38900



You can decrease the Himem value, but don't set the value to be greater than 38900. If you work with machine code, then you ought to know that zero page address 166 and 167 holds the Himem value, so that you don't have to operate in Basic, only because of the Himem.

The next lines to be written, if the status area only contains the value 85(# 55), is:

line number FOR F = 38912 to 40011
line number POKE F,0
line number NEXT F

Don't enter Hires mode. The Temo will, after the first run, prevent this by Poking 704,0.

Don't use the commands Grab and Release. Don't Poke or Doke the memory blocks 38900-38911 and 40012-40620.

Check and double check your programs, and don't forget to Save them. You're allowed to Poke or Doke addresses 100-122, as these locations are used by the Temo program.

The character that you choose to be your sprite must be in succession, e.g., A,B,C,D or #,$,%,&.

The Temo program will handle all sprites — depending on address 105 — when called.

If you don't want to use the Temo command !, then

CALL 40396 ■

```
0 HIMEM 38892
10 FOR F=38912 TO 40011
20 POKE F,0
30 NEXT F
40 N=5
50 POKE 105,N
60 FOR F=38892 TO 38899
70 READA
80 POKE F,A
90 NEXT F
100 DATA 18,12,30,45,45,30,18,0
105 GOSUB 60000
110 POKE 38912+N*2-2,1
120 POKE 39012+N*2-2,15
130 POKE 39112+N*2-2,15
140 DOKE 39212+N*2-2,46080+(8*ASC("a"))
150 DOKE 39712+N*2-2,38892
160 POKE 39812+N*2-2,ASC("a")
170 DOKE #2F5,40396
180 !
190 FOR F=1 TO 200
200 Y=PEEK(39012+N*2-2)
210 Y=Y+1
220 POKE 39012+N*2-2,Y
230 X=PEEK(39112+N*2-2)
240 X=X+1
250 POKE 39112+N*2-2,X
260 !
270 NEXT F
280 POKE 38912+N*2-2,0
290 !
300 END
500 HIMEM 38900
505 FOR F=1 TO 8:READ A:NEXT F:REM *ELIMINATES THE DA
TA VALUES IN LINE 100*
510 GOSUB 60000
520 FOR F=38912 TO 40011
530 POKE F,0
540 NEXT F
550 FOR F=1 TO 20
560 POKE 38912+F*2-2,1
570 NEXT F
580 C=0
590 FOR F=1 TO 20
600 POKE 39112+F*2-2,C
610 C=C+12
620 NEXT F
625 Y=20
630 FOR F=1 TO 20
640 POKE 39012+F*2-2,20
650 NEXT F
660 C=33
665 FOR F=1 TO 20
670 DOKE 39212+F*2-2,46080+(8*C)
680 C=C+4
690 NEXT F
700 C=64888:REM ADRESS TO ORICS ROM DEFINED CHARACTER
S
710 FOR F=1 TO 20
720 DOKE 39712+F*2-2,C
730 C=C+8
740 NEXTF
750 C=33
760 FOR F=1 TO 20
770 POKE 39812+F*2-2,C
780 C=C+4
790 NEXT F
795 POKE 105,20
800 DOKE #2F5,40396
802 PAPER0:INK7
803 POKE 48035,0:REM CAPS OFF
804 POKE #26A,10:REM CTRL-O & CTRL-F
805 CLS
810 !
820 Y=Y+1
830 FOR F=1 TO 20
840 POKE 39012+F*2-2,Y
850 NEXT F
860 IF Y=200 THEN END
870 GOTO 810
10000 REM *************************
10001 REM * TEMO SPRITES V1,0     *
10002 REM * (C) MATTIAS GYLLERUP  *
10003 REM *      TOLLARP          *
10004 REM *      SWEDEN           *
10005 REM *************************
60000 FOR F=40012 TO 40618
60010 READ A
60020 POKE F,A
60030 NEXT F
60040 DATA #A5,100,#A2,0,#C9,8,#90,6,#38,#E9,8,#E8,#D
0,246,#85,102,#E0,0,#F0
60050 DATA 16,#18,#A5,106,#69,40,#85,106,#A5,107,#69,
0,#85,107,#CA,#D0,240,#60
60060 DATA#A5,101,#A2,0,#C9,6,#90,6,#38,#E9,6,#E8,#D0
,246,#85,103,#8A,#18,#65
60070 DATA106,#85,106,#A5,107,#69,0,#85,107,#60
60080 DATA#A6,102,#D0,1,#60,#A0,14,#B1,108,#C8,#91,10
0,#00,#88,#10,247,#A9,0
60090 DATA #C8,#91,108,#CA,#D0,237,#60
60100 DATA #A5,103,#D0,1,#60,#18,#A5,108,#69,16,#85,1
10,#A5,109,#69,0,#85,111
60110 DATA#A0,0,#A9,0,#85,112,#B1,108,#A6,103,#4A,#66
,112,#CA,#D0,250,#91
60120 DATA 108,#18,#66,112,#A6,112,#A5,112,#91,110,#C
8,#C0,16,#D0,226,#60
60130 DATA#A5,115,#10,2,#49,128,#C9,32,#F0,35,#90,33,
#38,#E9,32,#AA,#18,#A5
60140 DATA113,#69,8,#85,113,#A5,114,#69,0,#85,114,#CA
,#D0,240,#A0,0,#B1,113
60150 DATA #11,108,#91,108,#C8,#C0,8,#D0,245,#60
60160 DATA #A9,0,#A0,8,#91,108,#C8,#C0,32,#D0,249,#60

60170 DATA #A0,0,#B1,106,#85,116,#C8,#B1,106,#85,118,
#A0,40,#B1,106,#85,117
60180 DATA #C8,#B1,106,#85,119,#60
60190 DATA#A2,0,#85,114,#85,115,#48,#8A,#48,#98,#48,#
20,218,156,#68,#A8,#68
60200 DATA #AA,#68,#A9,0,#85,113,#A9,181,#85,114,#18,
#A5,108,#69,8,#85,108
60210 DATA #A5,109,#69,0,#85,109,#E8,#E0,4,#D0,213,#6
0
60220 DATA #A0,0,#A5,104,#91,106,#C8,#AA,#E8,#E8,#8A,
#91,106,#A0,40,#AA,#CA
60230 DATA #8A,#91,106,#C8,#AA,#E8,#E8,#8A,#91,106,#6
0
60240 DATA #A0,0,#A5,116,#91,106,#C8,#A5,118,#91,106,
#A0,40,#A5,117,#91,106
60250 DATA #C8,#A5,119,#91,106,#60
60260 DATA #A0,0,#B1,120,#91,108,#C8,#C0,8,#D0,247,#6
0
60270 DATA #A5,122,#18,#65,122,#A8,#A5,106,#99,232,15
5,#A5,107,#99,233,155
60280 DATA #60
60290 DATA #A5,122,#18,#65,122,#A8,#A5,116,#99,144,15
3,#A5,117,#99,244,153
60300 DATA #A5,118,#99,88,154,#A5,119,#99,188,154,#60
60310 DATA #A9,0,#85,144,#A9,152,#85,167
60320 DATA#A9,0,#8D,192,2,#A5,105,#C9,30,#B0,4,#C9,0,
#D0,1,#60,#A9,0,#85,122
60330 DATA#A5,122,#18,#65,122,#A8,#B9,0,152,#C9,0,#D0
,15,#B9,1,152,#C9,0,#F0
60340 DATA56,#A9,0,#99,1,152,#18,#90,15,#B9,1,152,#C9
,0,#D0,8,#A9,1,#99,1
60350 DATA152,#18,#90,33,#B9,232,155,#85,106,#B9,233,
155,#85,107,#B9,144,153
60360 DATA#85,116,#B9,244,153,#85,117,#B9,88,154,#85,
118,#B9,188,154,#85,119
60370 DATA #20,117,157,#E6,122,#A5,105,#C5,122,#D0,17
2,#A5,105,#85,122,#C6
60380 DATA 122,#A5,122,#18,#65,122,#A8,#B9,0,152,#C9,
0,#D0,7,#B9,1,152,#C9,0
60390 DATA #F0,84,#A9,128,#85,106,#A9,187,#85,107,#A9
,0,#85,113,#A9,181,#85
60400 DATA 114,#B9,100,152,#85,100,#B9,200,152,#85,10
1,#B9,132,155,#85,104
60410 DATA #B9,44,153,#85,108,#B9,45,153,#85,109,#B9,
32,155,#85,120,#B9,33
60420 DATA 155,#85,121,#20,8,157,#20,140,157,#20,76,1
56,#20,113,156,#20,152
60430 DATA 157,#20,142,156,#20,167,156,#20,20,157,#20
,169,157,#20,43,157,#20
60440 DATA 89,157,#C6,122,#A5,122,#C9,255,#D0,144,#60
60450 RETURN
```

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1 REM (97 inverse video "2")

Edit this until you have lines 1 to 7, 97 inverse video 2 each. Enter the following Pokes as a direct command:

```
POKE 16510,0
POKE 16511,205
POKE 16512,2
POKE 16514,118
POKE 16515,118
```

To check whether the Rem-statement has the correct length, type:

PRINT PEEK 16396 + 256 * PEEK 16397

This should give 17230. Enter the following program and Run this.

```
10 FOR A = 16516 TO 17228
20 IF PEEK A< > 158 THEN POKE A,158
30 NEXT A
```

Thereafter delete this program and enter a hex-loader. Run the loader and type in all the hex-codes from listing 1. Delete the hex-loader line by line and type in the Basic program — listing 2.

Save the program auto-run by:

GOTO 350

The machine-code program transforms the normal display file into the high-resolution display file.

The code of a character in the normal display file corresponds with the eight codes of a UDG — User-Definable Graphic.

When the Basic program is run you are asked to define UDGs, or not. If the answer is no then the program will be stored above Ramtop including the character-set. If no UDGs were defined before, this set is empty. If the answer is yes the computer will ask for a character-code. Thereafter it will ask for the eight numbers to build up a UDG.

When you have completed the UDG-defining you have two options, either you can save the character-set including the complete program on tape, or — if you do not want to save on tape — it is all stored automatically above Ramtop.

When the program is stored above Ramtop, you can write your own program or load an existing one. A program should begin with:

RAND USR 25614

to put the computer in high-resolution mode. You can transform the normal display-file by:

RAND USR 25686

As CHR$ (0) is not transformed you should print a CHR$ (1) to remove a character from the high-resolution display — the transforming routine removes CHR$ (1) from the normal display file. Your own program should finish with:

RAND USR 25602

to put the computer back to normal resolution.

The high-resolution screen is cleared by:

RAND USR 25626

The character-set starts at address 16717 — this is in Ramtop: 25772. Do not use the ZX-81 Scroll, because the computer will crash. ■

```
 99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N;" - ";
170 INPUT A$
180 PRINT A$;" - ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=T THEN GOTO 310
290 PRINT "ERROR PLEASE INPUT A
GAIN"
300 GOTO 150
310 NEXT N
```

The hex loader.

```
 10 REM ** BASIC-HI-RES **
 20 PRINT "ENTER CODES FOR UDG"
"S ? (Y/N)"
 30 IF INKEY$="" THEN GOTO 30
 35 LET A$=INKEY$
 40 IF A$="N" THEN RAND USR 155
14
 50 IF A$="Y" THEN GOTO 100
 60 GOTO 30
100 CLS
110 PRINT "CHARACTER-NUMBER ? (
2-63)";
120 INPUT CN
130 IF CN<2 OR CN>63 THEN GOTO
120
140 PRINT CN
150 PRINT "ENTER 8 CODES..."
160 LET X=16717+(CN*8)
170 FOR A=X TO X+7
180 INPUT C
190 PRINT ,C
200 POKE A,C
210 NEXT A
220 PRINT "MORE CHARACTERS ? (Y
/N)"
230 IF INKEY$="" THEN GOTO 230
240 LET A$=INKEY$
250 IF A$="Y" THEN GOTO 100
260 IF A$<>"N" THEN GOTO 230
265 IF INKEY$<>"" THEN GOTO 265
270 PRINT "SAVE THESE CHARACTER
S ? (Y/N)"
280 IF INKEY$="" THEN GOTO 280
290 LET A$=INKEY$
300 IF A$="N" THEN RAND USR 155
14
310 IF A$<>"Y" THEN GOTO 280
320 CLS
325 IF INKEY$<>"" THEN GOTO 325
330 PRINT "PRESS ANY KEY TO SAV
E..."
340 IF INKEY$="" THEN GOTO 340
345 CLS
350 SAVE "BASIC-HI-RES"
360 RUN 20
```

Listing 2. The Basic program.

Listing 1. The hex codes.

```
16514 - 7676210064220440 = 471     16618 - 9202CD2002DD212D = 686
16522 - 21A1401100640185 = 557     16626 - 64C3A402E92A0C40 = 812
16530 - 02EDB0CDC3030000 = 818     16634 - 2311006706187EFE = 565
16538 - 00760002AE02EA76 = 648     16642 - 00280BFE01200236 = 394
16546 - 76CD2A0A3E1EED47 = 775     16650 - 00C5CD6464C1237E = 966
16554 - DD218102C9CD1A64 = 917     16658 - FE76200C23EBC501 = 884
16562 - 3E08ED47DD212D64 = 777     16666 - E90009EBC110DFC9 = 1110
16570 - C92100670EC00620 = 581     16674 - 1318DBE5D521AC64 = 1009
16578 - 369E2310FB36C923 = 804     16682 - E63F06004FCB21CB = 817
16586 - 0D20F3C921DFE611 = 992     16690 - 10CB21CB10CB21CB = 910
16594 - 2100F30EFE061610 = 588     16698 - 1009EB06081A7713 = 436
16602 - FE06C0ED78D3FF19 = 1300    16706 - D5112100190110F5 = 758
16610 - CD556405C23C64CD = 954     16714 - D1E1C9 = 635
```

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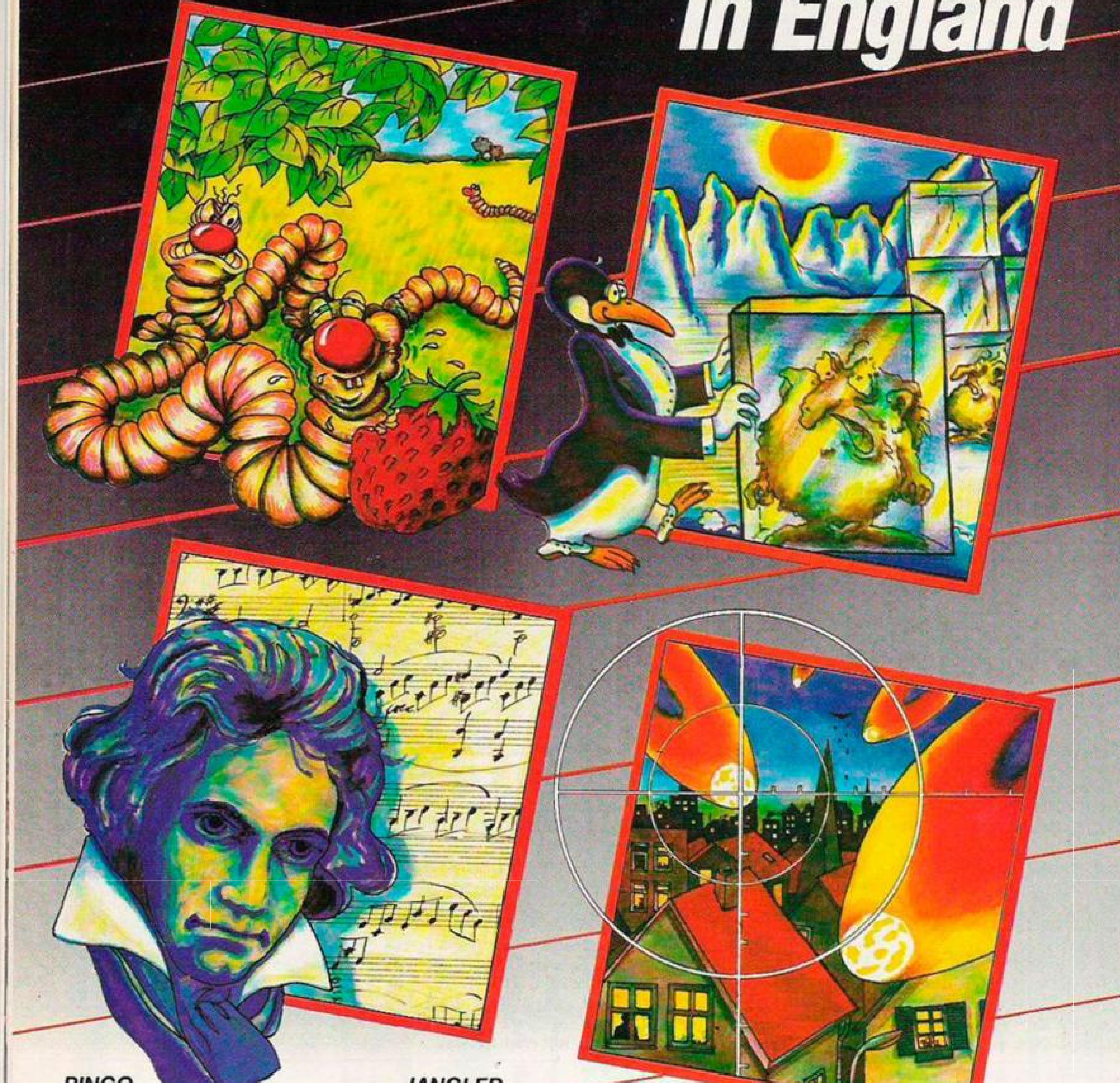

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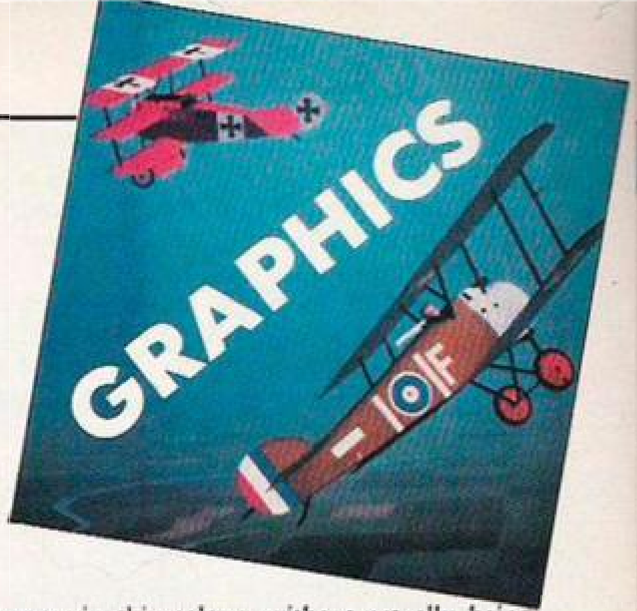

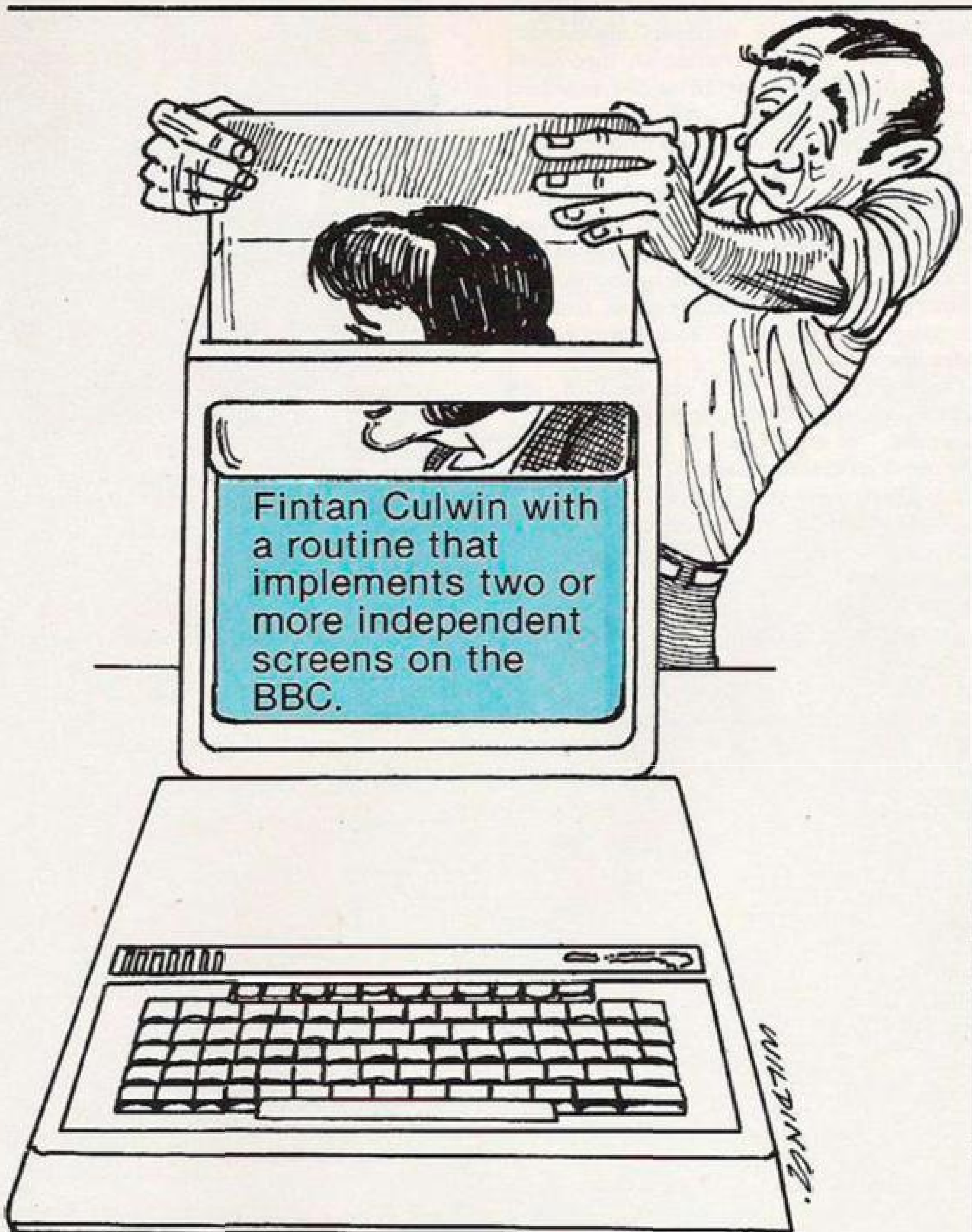

VIRTUAL SCREENS

IN THIS ARTICLE I will explain the concept of virtual screens and explain how the facility can be implemented on the BBC by a combination of in-built firmware and the machine-code utility presented. In order to do this it will be necessary to address screen memory directly. I will explain the basis of what I believe to be the best method of calculating a screen memory address.

Virtual screens can be configured on some other machines. The basis of the screen is to allow a multi-coloured mode to be used as two or more independent screens. Each virtual screen will have a lower number of colours, but the division does not take up any more memory. Applications for virtual screens include: having a permanent "help" screen on one virtual screen which can be accessed immediately from another virtual screen; allowing each user in a multi-user application to have an independent screen area; producing a screenful of information without the user seeing it; and revealing it instantaneously.

This last use of virtual screens is already partly catered for in the BBC's firmware. By using the VDU 19 command a logical colour can be assigned to the current background colour. Information can then be put on to the screen in this colour, without actually being visible. A second use of the VDU 19 command will then reveal the information — see User Guide page 164. What is not present in the BBC's firmware is a straight-forward method of removing the information so presented permanently from the screen.

This system will allow a four-colour mode to be used as two two-colour virtual screens. The 16-colour mode can be configured as two four-colour screens, four two-colour screens, or a two-colour screen combined with an eight-colour screen.

In order to explain how virtual screens can be produced it will be necessary to look at how colour information is coded in screen memory. In a four-colour mode each pixel is controlled by two bits in memory, this gives four possible combinations — 00 01 10 11; corresponding to the four permissible colours. In the 16-colour mode each pixel is controlled by four bits; giving the 16 possible combinations.

To return to the four-colour mode, if the left-hand and right-hand bits can be set and cleared independently in combination with the VDU 19 command then two independent screens can occupy the same memory space. It is possible to set the bits by using logical colours 1 and 2 respectively. Logical colour 0 is the background colour naturally and colour 3 will be displayed or set according to both bits and has to be ignored as a physical colour with virtual screens.

An example may make this clearer: If a pixel is to be displayed in virtual screen one then the right-hand bit has to be set. If it has to be displayed in virtual screen two then the left-hand bit has to be set. If both bits are set then the pixel will be displayed in both screens one and two. Consequently, when logical colours are assigned to display a virtual screen; colour three has to be assigned to the same colour as colour one or two. Similar considerations apply to the 16-colour mode working on four rather than two bits.

For a logical colour to be removed from the screen the bits which control it have to be cleared. To clear logical colour one the right-hand bit has to be cleared. This will have no effect on logical colour two controlled by the left-hand bit; but will affect logical colour three controlled by both bits. The effect will be to reset the pixel from logical colour 3 to 2, which is exactly what is required. The facility to clear just one bit in screen memory is not catered for in the firmware. The routines included here do just this. A set of procedures for controlling 16-colour mode virtual screens are given in listing 2.

(continued on next page)

(continued from previous page)

Having outlined how colour information is controlled by two or four bits, before presenting the utility, it will be necessary to show how these bits are organised in memory.

Screen memory occupies space between Himem for any mode and location 8000 hex. For a four-colour mode each byte will control four pixels. For the 16-colour mode each byte will control two pixels.

The relationship between where a byte appears on the screen and where it exists in memory is equally complex. For all modes apart from Mode 7 the first eight bytes from Himem onwards control an area of pixels on the top left-hand side of the screen. The next eight pixels control an area to the right of this. This continues until the right-hand side of the screen is met. The next byte either Himem+320 or Himem+640 and the subsequent seven bytes control an area underneath the area controlled by Himem to Himem+7.

Each complete set of 320 or 640 bytes corresponds to one row of characters on the screen. If we want to calculate a memory address from the X, Y text co-ordinates, each X co-ordinate will increase the memory address by 640 or 320 from Himem. All the published algorithms which I have seen concentrate on ingenious methods of multiplying by 320 or 640, in order to obtain the address.

This is totally unnecessary as a faster method is available within the firmware. Within the operating system Rom two tables are maintained — one for multiplying by 640 used for Modes 0 to 6 and one for multiplying by 40 for Mode 7. In order to find out the increase in memory address above Himem, all that is necessary is to use the X co-ordinate as an index into this table.

Once the virtual utility is installed in memory, either by assembling it from the code presented, or by loading a previously assembled version into memory, it can be used in one of two ways. Both methods require it to be Called with the first integer parameter indicating the virtual screen to be cleared. If this is the only parameter then the whole screen will be affected.

The second method will allow only a section of the screen to be cleared. The Call must now be accompanied by five integer parameters, the first is the virtual screen as before, the next four are the X left, X right, Y high and Y low co-

ordinates defining the area to be cleared.

The X co-ordinates are based on a 80-column screen for Modes 1 and 2. A 40-column resolution is available for Mode 5. No range checking is performed on these co-ordinates; any outside the range will cause unexpected and possibly dramatic effects. If an incorrect number of parameters are passed then a "virtual error" error message will be given.

To use the assembler code an assembly address will have to be given and the screen

(continued on page 119)

Main program.

```
 100REM VIRTUAL SCRENS MODE 1
 110REM FRI  JULY 9PM ??
 120PROC_OPTIONS
 130MODE mode
 140FOR opt =  0 TO 3 STEP 2
 150P%=assemble
 160PROC_DATA
 170PROC_PARAMATERS
 180PROC_MAIN
 190PROC_SCREEN
 200NEXT opt
 210PROC_TEST
 220 MODE 7
 230 PRINTTAB(8)"VIRTUAL SCREEN"
 240 PRINT'''"CODE ASSEMBLED AND TESTED"
 250 PRINT''"START ADDRESS ";~assemble
 260 PRINT''"END   ADDRESS ";~P%
 270 PRINT''"ENTRY ADDRESS ";~entry
 280 END
 500DEF PROC_OPTIONS
 510CLS
 520PRINTTAB(8)"VIRTUAL SCREENS"''''
 530PRINT"MODE (1,2 or 5)";
 540REPEAT
 550res=GET
 560UNTIL res=49 OR res=50 OR res=53
 570mode = res-48
 580IF mode = 1 OR  mode = 5 THEN fourcol=TRUE ELSE f
ourcol = FALSE
 590IF mode=5 THEN threetwenty=TRUE ELSE threetwenty=
FALSE
 600IF fourcol THEN cols = 4 ELSE cols = 16
 610INPUT''"ASSEMBLY ADDRESS" &"address$
 620assemble=EVAL("&"+address$)
 630ENDPROC
 1000DEF PROC_PARAMATERS
 1010[ OPT opt: .entry
 1020           LDA &355
 1030           CMP mowde
 1040           BNE error \ branch if not correct mode
 1050           LDA &600
 1060           CMP #1
 1070           BEQ no_paramaters
 1080                   \ set up x and y default par
amaters
 1090           CMP #5
 1100           BEQ get_paramaters
 1110                   \ obtain passed paramaters
 1120.error     BRK
 1130]
 1140?P%=&00
 1150$(P%+1)="virtual error"
 1160P%?14=0
 1170P%=P%+17
 1180           REM error message
 1190 [ OPT opt : .no_paramaters
 1200           LDA #0
 1210           STA ylo
 1220           STA xleft
 1230           LDA #31
 1240           STA yhi
 1250           LDA #79
 1260           STA xright \ set up default paramaters
 1270           JMP main
 1280.get_paramaters
 1290           LDA &604
 1300           STA taddress
 1310           LDA &605
 1320           STA taddress+1
 1330           LDY #0
 1340           LDA (taddress),Y
 1350           CLC
 1360           ROL A
 1370           STA xleft   \ get and convert passed x
left
 1380           LDA &607
 1390           STA taddress
 1400           LDA &608
 1410           STA taddress+1
 1420           LDA (taddress),Y
 1430           CLC
 1440           ROL A
 1450           STA xright  \ get and convert xright
 1460           LDA &60A
 1470           STA taddress
 1480           LDA &60B
 1490           STA taddress+1
 1500           LDA (taddress),Y
 1510           STA yhi  \ get and stope yhi
 1520           LDA &60D
 1530           STA taddress
 1540           LDA &60E
 1550           STA taddress+1
 1560           LDA (taddress),Y
 1570           STA ylo  \ get and store ylo
 1580           JMP main
 1590]
 1600ENDPROC
 2000DEF PROC MAIN
 2010[ OPT opt
 2020 .main
 2030           LDA &601
 2040           STA taddress
 2050           LDA &602
 2060           STA taddress+1
 2070           LDA (taddress),Y
 2080           STA virtual  \ get and store requested
 colour
 2100 ]
 2110 IF fourcol THEN PROC_FOURCOL ELSE PROC_SIXTEENCO
L
 2120REM sets mask according to 4 or 16 colour mode an
d virtual wipe asked for
 2130 [ OPT opt
 2140 .endcond :INC xright
 2150           INC yhi  \ over set high values
 2160           LDA #HIMEM MOD 256
 2170           STA address
 2180           LDA #HIMEM DIV 256
 2190           STA address+1  \ set base address to HI
MEM
 2200           LDA ylo
 2210           CLC
 2220           ROL A
 2230           TAY             \ move 2*ylo to Y
 2240           LDA (table),Y  \ and use as index to *6
40 table
 2250           STA temp
 2260           INY
 2270           LDA (table),Y
 2280           STA temp+1
 2290 ]
 2300 IF threetwenty THEN PROC_HALFIT
 2310 [OPT opt
 2320           CLC
 2330           ADC address
 2340           STA address
 2350           LDA address+1
 2360           ADC temp
 2370           STA address+1  \ add 640 or 320 offset
to base address
 2380           LDA xleft
 2390           CLC
 2400           ROL A
 2410           ROL A
 2420           ROL A           \ A contains xleft *8
 2430           CLC
 2440           ADC address
 2450           STA address
 2460           LDA #0
 2470           ADC address+1
 2480           STA address+1 \ add to base address
 2490.next_row JSR one_row
 2500           CLC
 2510           LDA address
 2520           ADC bitlen
 2530           STA address
 2540           LDA address+1
 2550           ADC bitlen+1
 2560           STA address+1  \ add 320 or 640 to base
 address
 2570           INC ylo
 2580           LDA ylo
 2590           CMP yhi
 2600           BCC next_row  \ do one more row if not
finished
 2610           RTS             \ main return when finish
ed
 2620]
 2630ENDPROC
 3000DEF PROC_SIXTEENCOL
 3010[ OPT opt
 3020           TAY
 3025           DEY
 3030           LDA #&80    \ A contains base mask
 3040           SEC
 3050.mask_it  ROL A
 3060           ROL A
 3070           DEY             \ move base mask across as
indicated by
 3080           BPL mask_it \ value of A on entry to pr
oduce mask
 3085           EOR #&FF
 3090           STA mask
 3100]
 3110ENDPROC
 3120DEF PROC_FOURCOL
 3130[ OPT opt
 3140           CMP #1
 3150           BNE mustbe2 \ if not 1
 3160           LDA #&0F
 3170           STA mask
 3180           JMP endcond
 3190.mustbe2  LDA #&F0    \ mask for virtual colour 2
 3200           STA mask
 3210 ]
 3220ENDPROC
 4000DEF PROC SCREEN
 4010[ OPT opt
 4020.one row
 4030           LDX xleft
 4040           STX txleft  \ take temporary copy of xl
eft
 4050           LDA address
 4060           STA taddress
 4070           LDA address+1
 4080           STA taddress+1   \ take temporary copy o
f base address
 4090.next char JSR one char
 4100           CLC
 4110           LDA taddress
 4120           ADC #8
 4130           STA taddress
 4140           LDA taddress+1
 4150           ADC #0
 4160           STA taddress+1 \ add 8 to temp copy of
base address
 4170           INC txleft
 4180           LDA txleft
 4190           CMP xright
 4200           BCC next_char \ do another 8 byte block
 if not finished
 4210   .       RTS
 4220.one_char
 4230           LDY #7
 4240.one_pix
 4250           LDA (taddress),Y
 4260           AND mask
 4270           STA (taddress),Y
 4280           DEY
 4290           BPL one_pix  \ do one block of 8
 4300           RTS
 4310]
 4320ENDPROC
 8000DEF PROC_HALFIT
 8010[OPT opt
 8020           CLC
 8030           ROR temp
 8040           ROR temp+1
 8050           LDA temp+1  \ changes xlo*640 to xlo*32
0
 8060]
 8070ENDPROC
 9000DEF PROC_DATA
 9010[ OPT opt
 9020.yhi NOP
 9030.ylo NOP
 9040.xleft NOP
 9050.xright NOP
 9060.virtual NOP
 9070.mask NOP
 9080.address NOP :NOP
 9090.temp NOP : NOP
 9100.txleft :NOP
 9110.mowde :NOP
 9120.bitlen :NOP : NOP
 9130]
 9140taddress = &70
 9150table = &72
 9160?table = &75
 9170table?1= &C3  : REM address of *640 table
 9180?mowde = mode
 9190IF threetwenty THEN ?bitlen=&40:bitlen?1=1 ELSE ?
bitlen=&80:bitlen?1=2
 9200REM bitlen is address difference between rows: 32
0 or 640
 9210ENDPROC
10000DEF PROC_TEST
10010 IF fourcol THEN kols=2 ELSE kols=4
10020 VDU24,0;112;179;1039;28,0,31,19,28,
10030 IF NOT fourcol THEN VDU19,8,1;0;19,0,5;0;
10040 FOR thiscol = kols TO 1 STEP -1
10050 IF fourcol THEN GCOL 0,thiscol ELSE GCOL 0,2^thi
scol
10060 PLOT4,512-thiscol*100,512-thiscol*100
10070 PLOT4,512+thiscol*100,512-thiscol*100
10080 PLOT85,512+thiscol*100,512+thiscol*100
10090 PLOT4,512-thiscol*100,512+thiscol*100
10100 PLOT85,512-thiscol*100,512-thiscol*100
10110 NEXT thiscol
10120 FOR thiscol%=1 TO kols
10130 PRINT"PRESS ANY KEY TO"''"TEST VCOL ";thiscol%
10140 res = GET
10150 CALL entry,thiscol%
10160 NEXT
10170 R=GET
10180 ENDPROC
```

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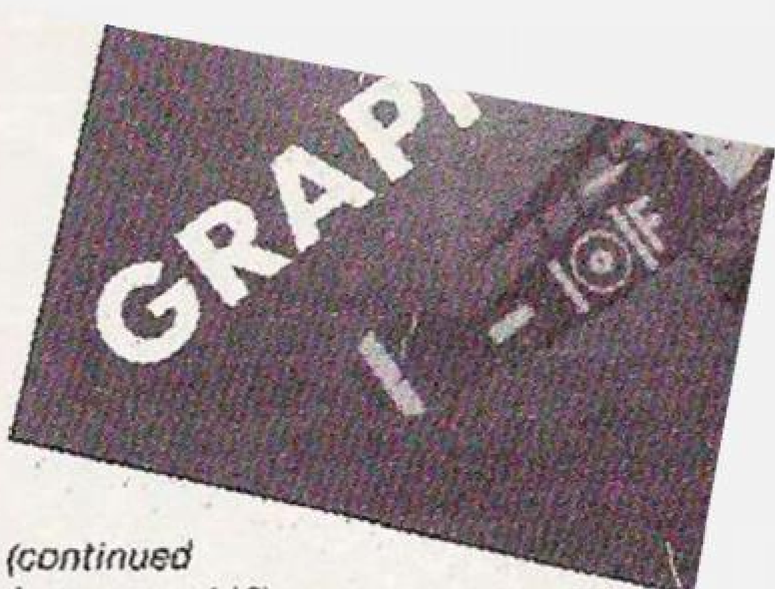
```
    TRATION OF CONFIGURING TWO
    OLOUR VIRTUAL SCREEN IN MODE 2
    AR CONSIDERATIONS WILL APPLY
    HER CONFIGURATIONS

    al(3)
    to hold actual colours
    &D10
    y address to machine code
    SPLAY(2,3,4,0,6)
    pare to write on screen one by displaying

    4 : PRINTTAB(5,5)"HELLO"
    8 : PRINTTAB(5,7)"HELLO"
    12 : PRINTTAB(5,9)"HELLO"
    AB(5,11)"THIS IS"''TAB(5)"SCREEN ONE"''TAB
    NY KEY"
    DISPLAY(1,0,1,7,2)
    display screen one, and write screen two
    R 1 : PRINTTAB(5,6)"HELLO"
    R 2 :PRINTTAB(5,8)"HELLO"
    R 3 :PRINTTAB(5,10)"HELLO"
    TAB(5,12)"THIS IS"''TAB(5)"SCREEN TWO"''TAB(
    ANY KEY"
    ET
    C_DISPLAY(2,3,4,0,6)
    M switch screens
    GET
    ROC_DISPLAY(1,3,4,0,6)
    =GET
    ROC_DISPLAY(2,0,1,7,2)
    =GET
    a%=3:CALL virtual,a%
    a%=4:CALL virtual,a%
    REM screen two displayed : clear screen one
    COLOUR 4 :PRINTTAB(3,5)"SCREEN ONE "''TAB(1)"HAS
    VIRTUALLY"''TAB(3)"CLEARED !!"
    PROC_DISPLAY(1,6,0,4,3)
    REM write and display screen one
  0 a%=1 : CALL virtual,a%
  0 a%=2 : CALL virtual,a%
 20 COLOUR 2 :PRINT TAB(3,6)"SO HAS "''TAB(3)"SCREEN
 O "''TAB(3)"GOODBYE !!"
 21 REM clear and write screen two
 30 PROC_DISPLAY(2,0,1,7,2)
 99 STOP
000  DEF PROC_DISPLAY(screen%,col0,col1,col2,col3)
010 REM paramaters are screen to be written and four
actual colour numbers
1020 actual(0)=col0:actual(1)=col1
1030 actual(2)=col2:actual(3)=col3
1040 REM store actual colour numbers
1050 screen% = screen% MOD 2
1060 REM set screen% to 0 or 1
1070 IF screen% = 0 THEN mask%=3 ELSE mask%=12
1080REM set mask as necessarry
1090 FOR logical%=0 TO 15
1100REM consider each logical colour
1110 REM consider each logical colour in turn
1120 masked_out = logical% AND mask%
1130 REM mask out bits
1140 IF screen%=1 THEN masked_out = masked_out DIV 4

1150 REM reduce to lo bits if hi bits
1160 REM value now in range 0-3 ( 2 bits)
1170 VDU19,logical%,actual(masked_out);0;
     NEXT logical%
        on appropiate actual colours according t
```



(continued from page 116)
mode selected. After the code has assembled, a test routine will be initiat information given to allow the code to b As conditional assembly is involved the length of the code cannot be given. assemble in its longest version into two pages of memory (/K). A differer of the code will have to be assemble screen mode.

The notes that follow should help stand what each section is doing.

The first procedure met is P which selects the mode to be cor the assembly address. Various flag according to the mode chosen.

Within the actual assembly loo used to set up a data block. Mo used within the program. The l "table" is a page zero addres point to the *640 table at addr location labelled "mowde" co the code is assembled for, and 320 or 640 depending on the

The parameters are proce assembled by Proc-Paramet the entry point to the code commences by testing the machine and branching to this is incorrect. The nu passed is then tested an used if this is inappropri page 214 for an explana meters are picked up. T either picked up from t page 6 or set to the defa This section exits to " of a basic error messa routine, is explained 446.

Main commences screen colour to be according to four o screen address is formula Himem Xleft*8. Each ro row", the base and a check mad processed. The routine.

Proc-Screen actually contro led "one-row" A copy of th taken. One c xleft and the return is ma have been d byte block mask prev

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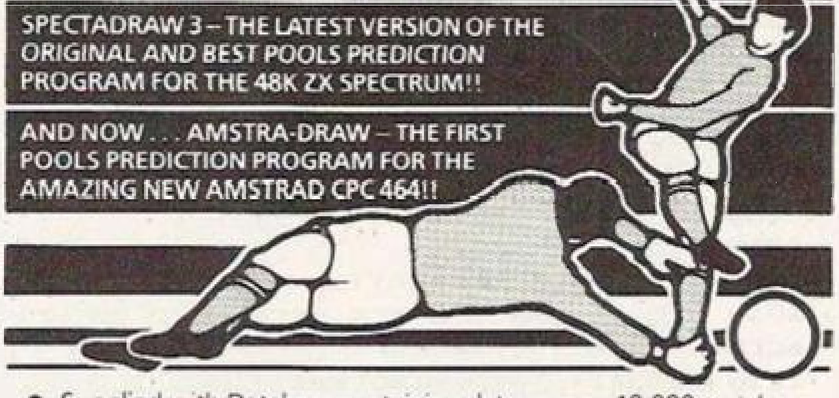

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SCREEN EXPANDER

Chris Woods gives Dragons a 128-character screen, plus 28 extra commands.

A SERIOUS LIMITATION of the Dragon is that the screen is only 32 characters wide. Various attempts have been made to remedy this, the best of which gave a mere 51 characters. The following program gives more than double this, in fact an astonishing 128 characters.

This amazing width is accomplished by displaying a section — the size of the normal text screen — at a time.

For the sake of speed and simplicity to the user I have written the entire program in machine code which can be accessed with the use of new Basic commands. The program introduces 23 new instructions altogether, from a sound-enveloping command to one that manipulates the video chip.

To enter the program first type the hex-loader — listing 1 — and Run it. Enter the first line of hex values from the machine-code dump, pressing Enter after each one. The loader will then ask for the line total which is the decimal number after = sign. Type it in and press Enter. If you have typed in the values correctly, the screen will clear and you can carry on, if not, you will have to re-enter the line.

When you have entered all the lines the program will end. Then save the code with:

CSAVEM "BASIC + ", 31522, 32768, 31522

I suggest that you save it twice just in case there is a recording error. Then switch the computer off then on and type in

CLEAR 200,23329

Rewind the tape and type

CLOADM "BASIC + "

Once it has loaded, type Exec. The following message should then appear:

(C) 1982 DRAGON DATA LTD
17K BASIC INTERPRETER
(C) 1984 BY MICROSOFT & C. WOODS

If it does not then there is a mistake in the machine code. The program is now initialised and the extra Basic commands available.

If you do not want the large screen, type

CLEAR 200,31521

instead which uses less memory.

Now to the commands. The maximum values for the parameters are in brackets — the minimum values are always zero.

Move X, Y (96, 48): This command specifies which part of the screen is to be displayed. In figure 1, the shaded area is the section which will be displayed. The X and Y coordinates refer to the top left-hand corner of the shaded area.

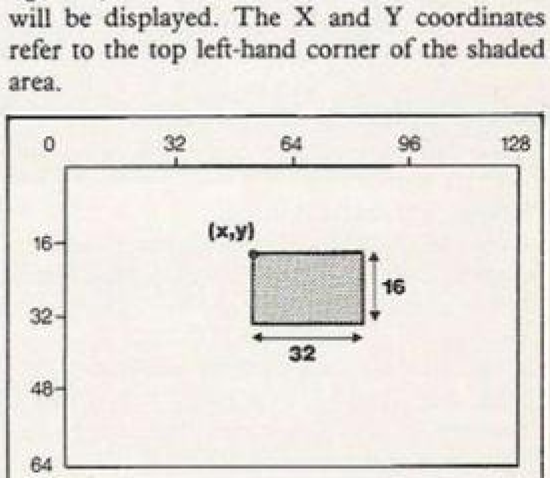


Figure 1.

Disp: After the coordinates have been specified, Disp displays the chosen area.

Copy: This is the opposite of Disp. It copies the text screen into the previously chosen area.

Clr N (255): This fills the whole — 128 by 64 — screen with characters of code N.

Up, Down, Left, Right: These four commands scroll the screen in the appropriate

(continued on next page)

Listing 2. The commands in action.

```
10 CLR 32
20 X=48:Y=24
30 R=RND(4)
40 X=X+(R=1 AND X>0)-(R=2 AND X<96)
50 Y=Y+(R=3 AND Y>0)-(R=4 AND Y<96)
60 MOVE X,Y:DISP
70 PRINT@272,"x";:COPY
80 GOTO 30
```

Listing 1. The hex loader.

```
10 CLEAR 200,31521
20 FOR A=31522 TO 32754 STEP 14
30 CLS
40 Z=160
50 CS=0:PRINT@0,"LINE VALUE =";A;
60 FOR B=A TO A+13
70 PRINT@64,"HEX VALUE          ";:PRINT@74,"";:INPUT H$:H=VAL("&H"+H$
):IF LEN(H$)<>2 THEN PLAY"L5AGA":GOTO 70
80 PRINT@(B-A)*2+Z,H$:POKE B,H:CS=CS+H:PRINT@32,"LINE TOTAL =";CS;
90 NEXT B
100 PRINT@96,"CHECKSUM";:INPUT LT:IF LT<>CS THEN PRINT@448,"INCORRE
CT LINE.PRESS ANY KEY TO TRY AGAIN.";:Z=Z+32 ELSE 120
110 IF INKEY$="" THEN 110 ELSE PRINT@448,"
                 ";:GOTO 50
120 NEXT A
```

Listing 3. Demonstration of the envelope command.

```
10 CLS
20 INPUT"L,F";L,F
30 PRINT"PRESS ANY KEY TO CHANGE L AND F"
40 ENV L,F,RND(63),RND(63),RND(63),RND(63),RND(63),RND(63),RND(63),
RND(63),RND(63),RND(63),RND(63),RND(63)
50 IF INKEY$="" THEN 40 ELSE 10
```

The hex dump.

```
31522 ---- 8E 7B 49 BF 01 7A 86 7E B7 01 79 8E 7D FC  = 1736
31536 ---- BF 01 68 8E 7E 26 BF 01 6B BD BA 77 8E 7F  = 1664
31550 ---- A8 BD 90 E5 8E 00 00 BF 7F FE 39 81 80 25  = 1795
31564 ---- 01 39 B7 7F FB BE 00 A6 10 8E 7F 1D B6 7F  = 1598
31578 ---- FB A1 A4 26 20 CE 00 00 A6 21 4A E6 86 33  = 1540
31592 ---- C5 81 00 26 F7 11 A3 22 26 0D E6 21 5A 3A  = 1287
31606 ---- BF 00 A6 AD B8 04 86 A9 39 31 26 A6 A4 81  = 1624
31620 ---- 2A 26 D1 B6 7F FB 39 BD 00 9F BD 8E 83 1F  = 1747
```

(hex dump continued on next page)

(continued from previous page)

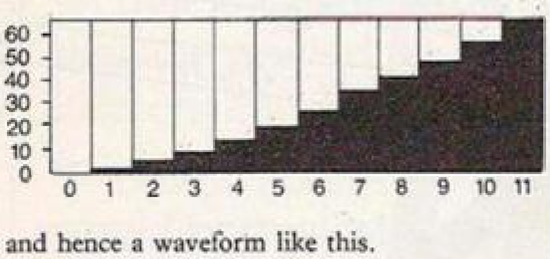
directions. In fact they change the X or Y coordinates — as in Move — by +1 or −1 and then activate a Disp command.

Epson: This dumps the whole screen out to an Epson RX or FX printer. All graphics symbols are printed out as a G. Yes it will print 128 characters on an 80-character Epson.

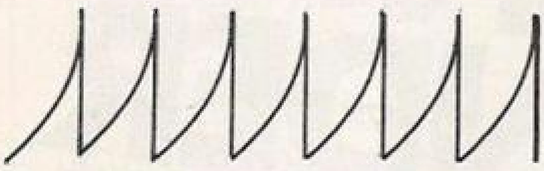
Listing 2 shows some of these commands in action.

Env L,F, A1, A2 . . . A14 (255, 255, 63, 63 . . ., 63): This command allows you to define the waveform, frequency and length of a sound. L and F specify the Length and Frequency of the sound respectively. A1 to A12 specify the amplitude — volume — of the sound at each of the 12 stages in each cycle.

Example: Env 20,50, 1,2,5,8,13,18,25,32,39, 47,55,63, would product the following cycle:



and hence a waveform like this.



Listing 3 demonstrates this command.

Noise L (65535): This command produces white noise of length L.

Repon T1, T2 (255, 255): An auto-repeat facility can be very useful, Repon gives this. The command causes the keyboard to repeat T1/50 seconds after the key was pressed and then after every T2/50 seconds.

Repoff: This cancells Repon.

Beepon L: This command causes the Dragon to emit a note of length L each key-press.

Beepoff: This cancels Beepon.

Fast: This command puts the Dragon in fast mode — obviously this will cause problems on some Dragons.

Slow: This puts the Dragon into slow mode.

Pause N (65535): This causes the Dragon to wait for N 50ths of a second.

Slpron N (65535): This slows down the Dragon printing routine. The larger N is, the slower the printing.

Slproff: This cancels Slpron.

Vdgst N (65024): This extremely useful command instructs the VDG chip where the graphics memory should start. For example:

```
10 VDGST 0: GOTO 10
```

This program displays memory locations 0-511 on the text screen in real time — it is quite interesting. Due to limitations of the hardware N must be a multiple of 512 (0, 512, 1024 . . .).

When using this command with graphics it should be after Screen command.

Trans F,T,L, (65535, 65535, 65535): This command moves a block of memory from F to T of length L.

Doke A,B (65535, 65535): This is a double Poke i.e., it is the same as:

POKE A,INT (B/256): POKE A + 1,B − 256 × INT (B/256)

Note that you may use any variables, expressions or numbers with these commands.

(hex dump continued from previous page)

```
31634 ---- 10 F7 7F FE BD 89 AA BD 8E 83 1F 10 F7 7F  = 2023
31648 ---- FF BD 7C 1A BD 7F 14 39 BD 7C 1A 10 8E 04  = 1488
31662 ---- 00 86 10 EE 81 EF A1 4A 26 F9 30 88 60 10  = 1574
31676 ---- 8C 06 00 26 EE 39 BD 00 9F BD 8E 83 1F 10  = 1336
31690 ---- 81 00 10 26 0F BD 1F 98 8E 5B 22 ED 81 8C  = 1343
31704 ---- 7B 22 26 F9 BD 7F 14 39 BD 7C 1A 10 8E 04  = 1338
31718 ---- 00 86 10 B7 7F FD C6 20 A6 A0 A7 80 5A 26  = 1692
31732 ---- F9 30 88 60 7A 7F FD 26 EF 39 7C 7F FF BD  = 2060
31746 ---- 7B A8 39 7A 7F FF BD 7B A8 39 7C 7F FE BD  = 2083
31760 ---- 7B A8 39 7A 7F FE BD 7B A8 39 B6 7F FF 81  = 2081
31774 ---- 30 10 22 0F 6A C6 80 3D 1F 01 F6 7F FE C1  = 1458
31788 ---- 60 10 22 0F 5C 3A 30 89 5B 22 BF 7F FC 39  = 1248
31802 ---- 86 00 BD BD 1A 86 1B BD BD 1A 86 40 BD BD  = 1679
31816 ---- 1A 86 0F BD BD 1A 8E 5B 22 C6 80 A6 80 34  = 1518
31830 ---- 14 BD 7C 6D BD 85 1B 35 14 5A 26 F1 86 0D  = 1380
31844 ---- BD BD 1A 8C 7B 22 26 E5 39 81 80 24 12 81  = 1465
31858 ---- 60 24 09 81 40 24 02 8B 60 7E BD 1A 80 40  = 1140
31872 ---- 7E BD 1A 86 47 7E BD 1A BD 00 9F BD 8E 83  = 1697
31886 ---- BF 7C BA BD 89 AA BD 8E 83 BF 7C B8 BD 89  = 2284
31900 ---- AA BD 8E 83 8C 00 00 27 0F FE 7C BA 10 BE  = 1596
31914 ---- 7C B8 A6 C0 A7 A0 30 1F 26 F8 BD 7F 14 39  = 1751
31928 ---- FF FF F7 FF BD 00 9F BD 8E 83 8C 00 00 10  = 1978
31942 ---- 27 00 05 13 30 1F 26 FB BD 7F 14 39 BD 00  = 1013
31956 ---- 9F BD 8E 83 8C 00 00 10 27 00 19 86 3F B7  = 1221
31970 ---- FF 23 34 10 BD 97 72 B6 01 18 4A 26 FD 73  = 1499
31984 ---- FF 20 35 10 30 1F 26 EC BD 7F 14 86 B4 B7  = 1542
31998 ---- FF 23 39 BD 00 9F 10 8E 7D C4 34 20 BD 8E  = 1589
32012 ---- 83 35 20 1F 10 81 00 10 26 0E 76 E7 A0 34  = 1021
32026 ---- 20 BD 89 AA 35 20 10 8C 7D D1 26 E2 34 20  = 1451
32040 ---- BD 8E 83 35 20 1F 10 81 00 10 26 0E 58 E7  = 1110
32054 ---- A4 B6 7D C4 10 27 00 78 B6 7D C5 10 27 0E  = 1415
32068 ---- 48 8E 7D C6 86 C0 A5 80 10 26 0E 3D 8C 7D  = 1550
32082 ---- D2 26 F5 70 7D C5 B6 7D C4 C6 80 3D 1F 01  = 1849
32096 ---- B6 7D C5 C6 02 3D C3 00 0B 44 56 44 56 FD  = 1532
32110 ---- 7D D3 10 8E 00 00 1F 10 B3 7D D3 2B 04 31  = 1152
32124 ---- 21 20 F7 10 8C 00 00 26 02 31 21 10 BF 7D  = 922
32138 ---- C3 86 3F B7 FF 23 5F BD BA F1 10 BE 7D C3  = 2102
32152 ---- 33 8D 00 2A A6 C0 2B 12 48 48 8A 02 B7 FF  = 1375
32166 ---- 20 4F F6 7D C5 1F 01 BD 7D BD 20 EA 31 3F  = 1592
32180 ---- 26 E2 BD 7F 14 BD 7C FB 39 30 1F 12 26 FB  = 1607
32194 ---- 39 00 0A 28 00 00 00 00 00 00 00 00 00 00  = 107
32208 ---- 00 00 FF 00 11 B7 FF D7 39 B7 FF D6 39 BD  = 1880
32222 ---- 00 9F BD 8E 83 8C 00 00 10 27 0D A3 BF 7D  = 1308
32236 ---- FF BD 7F 14 86 7E B7 01 67 39 86 39 B7 01  = 1570
32250 ---- 67 39 34 10 8E 03 E8 BD 7D BD 35 10 39 BD  = 1423
32264 ---- 00 9F BD 8E 83 8C 00 00 10 27 0D 79 BF 7E  = 1267
32278 ---- 33 BD 7F 14 86 7E B7 01 6A 39 86 39 B7 01  = 1369
32292 ---- 6A 39 34 12 86 3F B7 FF 23 86 FE B7 FF 20  = 1761
32306 ---- 8E 03 E8 73 FF 20 86 FF 4A 26 FD 30 1F 26  = 1650
32320 ---- F4 BD 7C FB 35 12 39 7D 7E ED 26 25 B6 FF  = 1936
32334 ---- 00 8A C0 81 FF 26 09 7F 7E EB 7F 7E EC 7E  = 1864
32348 ---- 9D 3D 7C 7E EB B6 7E EB 81 32 10 25 1E D3  = 1719
32362 ---- 86 FF B7 7E ED 20 29 7C 7E EC B6 7E EC 81  = 2167
32376 ---- 32 10 25 1E C0 7F 7E EC BE 01 12 30 01 BF  = 1263
32390 ---- 01 12 7F FF 02 B6 FF 00 8A C0 81 FF 26 06  = 1598
32404 ---- 7F 7E ED 7E 9D 3D CC FF FF FD 01 51 FD 01  = 2137
32418 ---- 53 FD 01 55 FD 01 57 B7 01 59 7E 9D 3D BD  = 1569
32432 ---- 00 9F BD 8E 83 1F 10 81 00 10 26 0C D0 F7  = 1318
32446 ---- 7E 65 BD 89 AA BD 8E 83 1F 10 81 00 10 26  = 1415
32460 ---- 0C BF F7 7E 78 BD 7F 14 8E 7E 47 BF 01 0D  = 1576
32474 ---- 7F 7E ED 7F 7E EB 7F 7E EC 39 8E 9D 3D BF  = 2075
32488 ---- 01 0D 39 FF FF FF BD 00 9F BD 8E 83 34 10  = 1714
32502 ---- BD 89 AA BD 8E 83 35 20 AF A4 BD 7F 14 39  = 1775
32516 ---- BD 00 9F BD 8E 83 1F 10 44 BD A9 9D BD 7F  = 1756
32530 ---- 14 39 BE 00 A6 30 1F BF 00 A6 39 44 04 01  = 999
32544 ---- 30 7B A8 43 04 01 3B 7B E0 43 03 00 E1 7B  = 1235
32558 ---- C2 55 02 00 A5 7B FE 44 04 01 38 7C 05 4C  = 1157
32572 ---- 04 01 2B 7C 0C 52 05 01 7E 7C 13 45 05 01  = 616
32586 ---- 85 7C 3A 46 04 01 2E 7D D5 53 04 01 45 7D  = 1056
32600 ---- D9 4D 04 01 37 7B 8B 44 04 01 23 7E EE 4E  = 1166
32614 ---- 05 01 7E 7C D2 45 03 00 E9 7D 01 54 05 01  = 987
32628 ---- 88 7C 88 50 05 01 7E 7C BC 56 05 01 88 7F  = 1275
32642 ---- 04 53 06 01 DE 7D DD 53 07 02 1C 7D F6 42  = 1219
32656 ---- 06 01 B9 7E 07 42 07 01 F7 7E 20 52 05 01  = 892
32670 ---- 84 7E AF 52 06 01 C2 7E E4 2A 20 28 43 29  = 1292
32684 ---- 20 31 39 38 32 20 44 52 41 47 4F 4E 20 44  = 819
32698 ---- 41 54 41 20 4C 54 44 0D 31 37 4B 20 42 41  = 829
32712 ---- 53 49 43 20 49 4E 54 45 52 50 52 45 54 45  = 1025
32726 ---- 52 0D 28 43 29 20 31 39 38 34 20 42 59 20  = 708
32740 ---- 4D 49 43 52 4F 53 4F 46 54 20 26 20 43 2E  = 909
32754 ---- 57 4F 4F 44 53 0D 0D 00 00 48 00 00 00 00  = 489
```

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- LLIST LPRINT recognised. High res screen dumps
- All control codes allowed through to printer
- Fully microdrive compatible
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YC/11/84

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The Spectrum Connection

THE FINAL TOUCH

We've just added the final touch to our professional keyboard.
This new Microdrive compatible keyboard offers more key functions than any other in its price range. And the stepped keys and space bar make it even easier to use.
Our keyboard, constructed from high density block ABS, will take your Spectrum into the professional league.
It has 52 "stepped" keys plus space bar. A separate numeric key pad consisting of 12 red keys including a single entry 'delete' plus single entry 'decimal point', facilitate fast numeric data entry.
The 15" x 9" x 3" case will accommodate your Spectrum and other addons like interface 1, power supply etc. and forms an attractive self-contained unit.
All connections, power, Mic, Ear, T.V., network RS232 and expansion port are accessible at the rear.
A few minutes, a screwdriver and the simple instructions supplied are all you need to fit your Spectrum.
All dk'tronics products are covered by a comprehensive guarantee.

Constructed from high density block ABS

All connections accessible at rear

FOLLOW OUR LEAD FOR THE RIGHT CONNECTIONS

MICRO DRIVE EXTENSION LEAD

This is an 8" version of the micro 16 way drive lead. Sinclair's lead is only 4" long and for many applications this may not be long enough. It enables you to space the micro drive much further away from Interface I.

56 WAY RIBBON CONNECTOR

This is an extension cable that enables Spectrum peripherals to be distanced from the computer.
It is supplied 9" in length and will allow male or female connections to be made to the computer.
The connector has special lugs to enable easy fitting/removal from the computer's expansion port.

WINNING IS WITHIN YOUR GRASP

Quickshot Joystick I

- Super positive response
- 2 fire buttons
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- 4ft lead

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Incorporating all the features of 'Quickshot I' plus

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Three Channel Sound Synthesiser interface incorporates a BEEP audio amplifier and a 3 channel sound sythesiser.
The BEEP amplifier improves the sound quality and output of the BEEP enormously. The 3 channel sound synthesiser adds a totally new dimension to sound on your Spectrum. It allows you to program your own music with harmonies, explosions, zaps, chimes, whistles and an infinite range of other sounds over a full 8 octaves. Based around the popular AY-3-8912 sound chip it gives you complete control (from basic or M/C) over 3 channels of tone and/or white noise, plus envelope and volume control. It comes with it's own pod mounted (4") speaker with 1 metre of cable so that it can be positioned anywhere.

Once this is fitted to the expansion port your programmes will never sound the same again!

Please rush me the following:

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Please add post and packing.....................£ 1.25
I enclose cheque/PO/Cash for ...... Total £______
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dk'tronics

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The Spectrum Connection

BILL DA

Patrick Edmond presents a gentle seasonal game for your CBM-64.

BILL DA SNOWMAN is a machine-code game for Christmas. It includes smooth scrolling — of the falling snow — and some Christmas music, though you will probably be fed up of hearing "Good King Wenceslas" and "While Shepherds Watched" after playing this game several times.

The aim of the game is to build a snowman before the timer counts from 1200 to zero. This is achieved by moving two small carts left and right to catch the falling snow and increase the snow counter. The best tactic is to catch the large snowflakes as these count for more points.

Santa Claus often visits, gliding across the sky in his sleigh pulled by his Reindeer. He might drop a few parcels which add 10 points each to your score but they do not help build the snowman, so if you are short of time concentrate on the snowflakes.

The right trolley is controlled by the following keys: M right; N left, and the left trolley these: Shift Key right; Commodore key left.

To cancel a game hold down the Ctrl key and press *. When a game has finished press Return to begin again. Note that joysticks cannot be used with this game. The snowman can be completed by increasing the snow counter to at least 21000, then the time remaining is multiplied by 10 and added to your score, then you begin building another snowman with a reduced time limit.

You can type Bill da Snowman exactly as shown and Save it, but there will be a long delay whenever you Run the program since the subroutine at line 200 takes a long time to Poke the data into memory. If you own an assembler this can be avoided as follows:

Type in lines 5 to 105 and add the following lines:

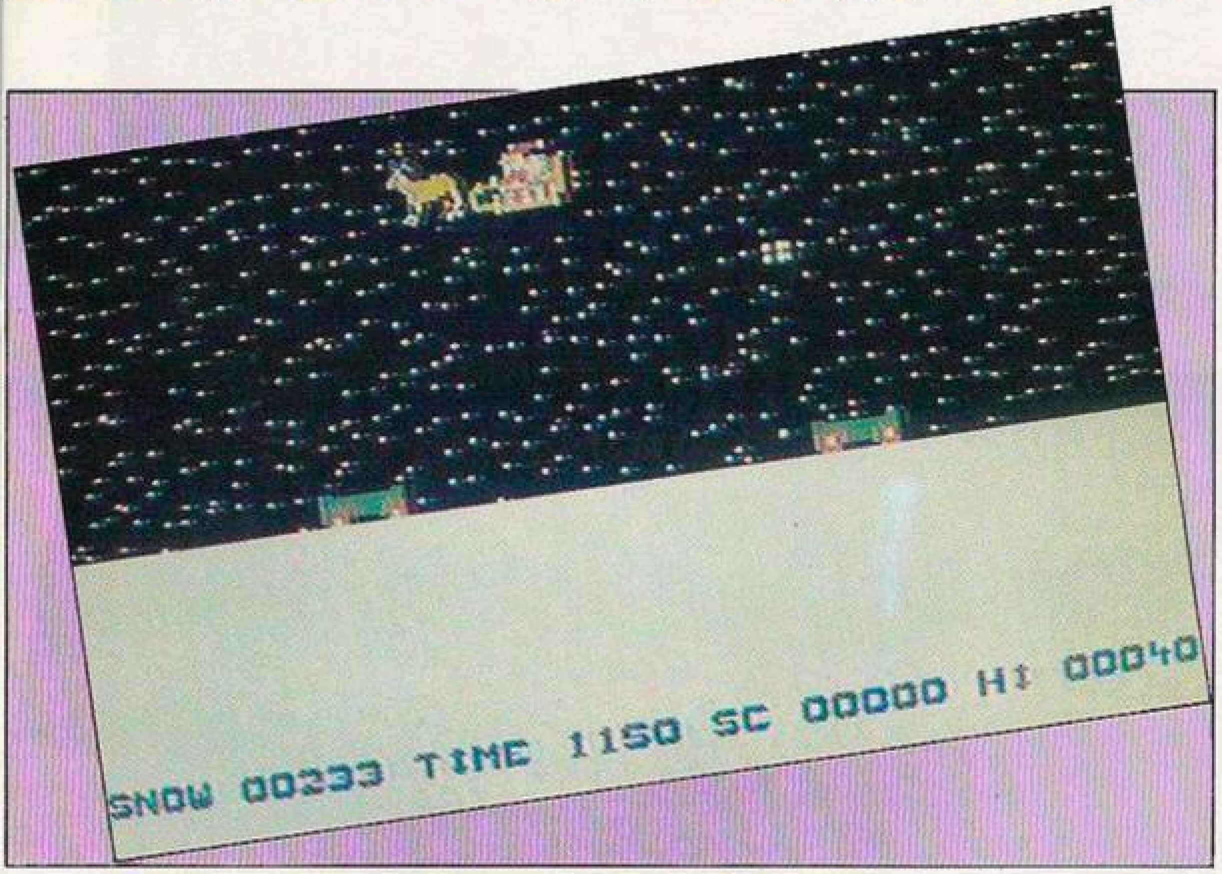
```
2 A=A+1:IFA=1 THEN LOAD"",1,1
110 SYS 17024
```

then Save this Basic "preload" program.

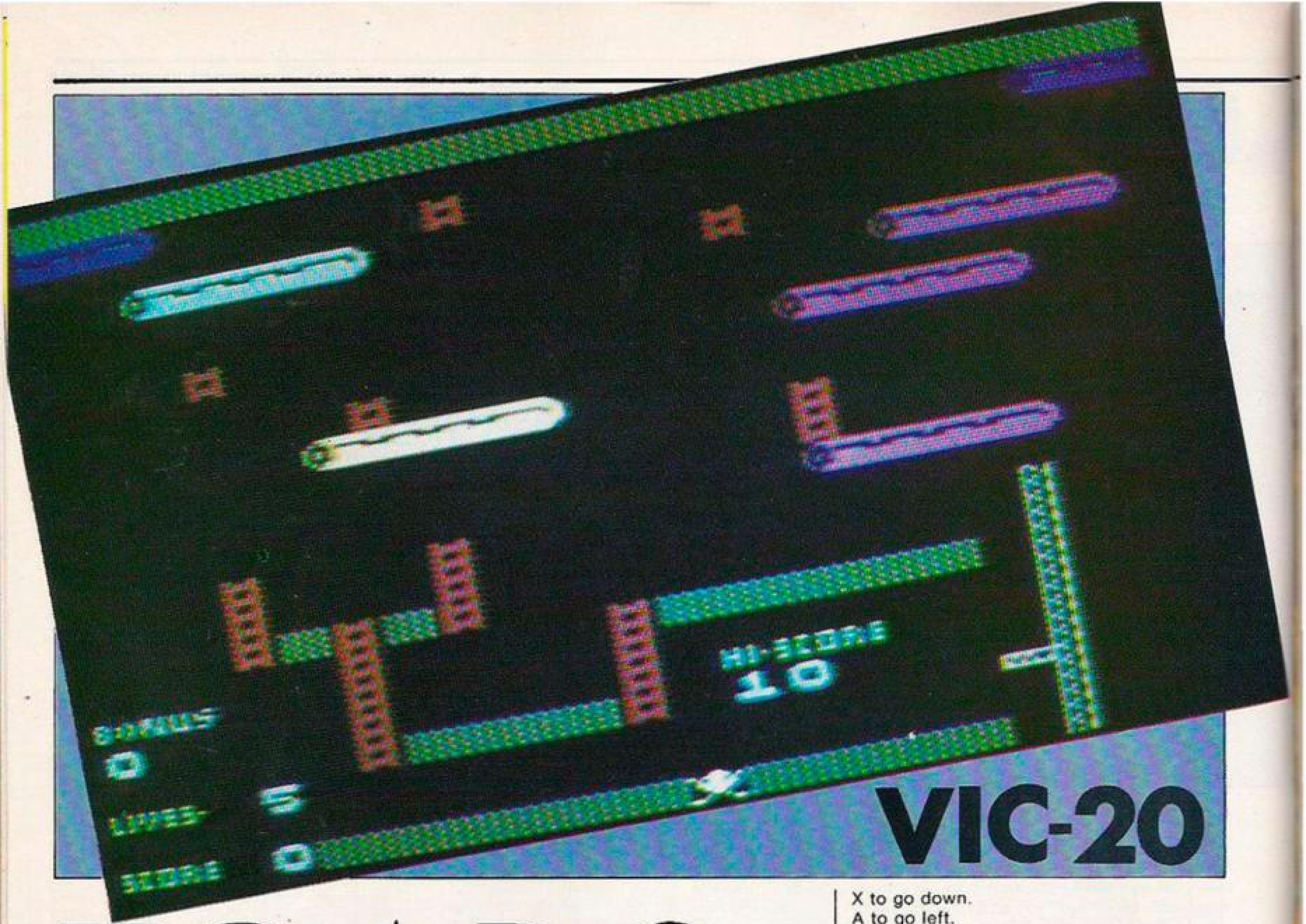
Next, with your assembler, enter the hex data of lines 1000 onwards into memory beginning at address $4000 (hex) and save memory from $4000 to $4A10 on cassette after the above "pre-load" program. You can then play the game by rewinding the tape and typing Shift and Run/Stop.

```
5 POKE53280,0:POKE53281,0
10 PRINT"■■  BILL DA SNOWMAN       BY P.EDMOND"
15 PRINT"
20 PRINT"■  MOVE THE TWO SMALL CARTS WITH THE"
25 PRINT"■ FOLLOWING KEYS :-"
30 PRINT"■ LEFT TROLLEY              RIGHT TROLLEY"
35 PRINT"■ C=              LEFT             N"
40 PRINT"■ SHIFT           RIGHT            M"
45 PRINT"■ COLLECT THE SNOWFLAKES, ESPECIALLY THE"
50 PRINT"■ LARGER ONES, TO BUILD YOUR SNOWMAN"
55 PRINT"■ BEFORE THE TIME RUNS OUT ."
60 PRINT"■ IF YOU COMPLETE THE SNOWMAN YOU BEGIN"
65 PRINT"■ AGAIN ,BUT WITH A SMALLER TIME LIMIT !"
70 PRINT"■           PRESS A KEY TO CONTINUE":POKE198,0
75 GETA$:IFA$=""THEN75
80 PRINT"■ PARCELS COUNT AS BONUS POINTS."
85 PRINT"■ PRESS 'CTRL' AND '*' TO CANCEL A GAME."
90 PRINT"■ WHEN A GAME HAS FINISHED PRESS 'RETURN"
95 PRINT"■ TO RE-START."
100 PRINT"■■■■ PRESS ANY KEY TO BEGIN":POKE198,0
105 GETA$:IFA$=""THEN105
200 PRINT" ■PLEASE WAIT, ENTERING DATA":I=16384
201 READA$:IFA$="*"THENSYS17024
202 L=ASC(LEFT$(A$,1))-48
203 IFL>9THENL=L-7
204 R=ASC(RIGHT$(A$,1))-48
205 IFR>9THENR=R-7
206 POKEI,L*16+R:I=I+1:GOTO201
1000 DATAEA,EA,EA,EA,EA,EA,EA,EA
1002 DATAEA,EA,A9,3F,8D,11,D0,A9
1004 DATA01,8D,21,D0,AD,12,D0,18
1006 DATAC9,AF,90,F8,A9,1F,8D,11
1008 DATAD0,A5,FF,18,65,F2,AA,18
1010 DATAC9,10,D0,02,A2,00,86,FF
1012 DATAE0,00,F0,03,4C,C7,40,A9
1014 DATA08,8D,4E,40,A9,06,8D,4F
1016 DATA40,8D,52,40,A9,30,8D,51
1018 DATA40,A0,00,A2,27,BD,00,04
1020 DATA9D,28,04,CA,10,F7,C8,C0
1022 DATA0E,F0,1F,AD,4E,40,38,E9
1024 DATA28,8D,4E,40,B0,03,CE,4F
1026 DATA40,AD,51,40,38,E9,28,8D
1028 DATA51,40,B0,03,CE,52,40,4C
1030 DATA4B,40,A2,27,AD,1B,D4,29
1032 DATA0F,9D,00,04,CA,10,F5,C6
1034 DATAFD,10,17,A9,03,85,FD,AD
1036 DATA1B,D4,29,1F,18,C9,10,90
1038 DATA03,18,69,06,AA,A9,10,9D
1040 DATA01,04,A2,03,DE,81,07,BD
1042 DATA81,07,C9,12,D0,16,A9,1C
1044 DATA9D,81,07,CA,10,EE,A2,03
1046 DATAA9,13,9D,81,07,CA,10,FA
1048 DATAA9,FF,85,F9,4C,D1,40,A2
1050 DATA06,A0,FF,88,D0,FD,CA,D0
1052 DATAFA,A5,FF,4A,09,10,8D,11
1054 DATAD0,A9,00,8D,21,D0,A6,FF
1056 DATABD,88,20,8D,0E,20,A9,0F
1058 DATA38,E5,FF,AA,BD,88,20,8D
1060 DATA13,20,A9,00,8D,8E,02,20
1062 DATA00,42,AD,8D,02,29,02,F0
1064 DATA0D,AD,02,D0,C9,16,F0,06
1066 DATA38,E9,02,8D,02,D0,AD,8D
1068 DATA02,29,01,F0,0D,AD,02,D0
1070 DATAC9,90,F0,06,18,69,02,8D
1072 DATA02,D0,A5,C5,C9,27,D0,12
1074 DATAAD,00,D0,C9,CE,F0,0B,38
1076 DATAE9,02,8D,00,D0,B0,03,CE
1078 DATA10,D0,A5,C5,C9,24,D0,12
1080 DATAAD,00,D0,C9,40,F0,0B,18
1082 DATA69,02,8D,00,D0,90,03,EE
1084 DATA10,D0,AD,00,D0,29,06,4A
1086 DATA18,69,22,8D,F8,07,AD,02
1088 DATAD0,29,06,4A,18,69,22,8D
1090 DATAF9,07,A5,FF,C9,00,F0,03
1092 DATA4C,B5,41,AD,02,D0,4A,4A
1094 DATA4A,AA,BD,2E,06,20,E8,41
1096 DATABD,2F,06,20,E8,41,A9,00
1098 DATA9D,2E,06,9D,2F,06,AD,00
1100 DATAD0,4A,4A,4A,AA,AD,10,D0
1102 DATA29,01,F0,05,8A,18,69,20
1104 DATAAA,BD,2E,06,20,E8,41,BD
1106 DATA2F,06,20,E8,41,A9,00,9D
1108 DATA2E,06,9D,2F,06,A2,A7,A9
1110 DATA40,8D,15,03,A9,0A,8D,14
1112 DATA03,A5,FF,4A,C9,07,D0,07
1114 DATAA2,A6,A9,00,8D,14,03,8E
1116 DATA12,D0,AD,11,D0,29,7F,8D
1118 DATA11,D0,AD,19,D0,09,81,8D
1120 DATA19,D0,68,A8,68,AA,68,40
1122 DATAF0,07,A8,29,10,F0,03,E6
1124 DATAFB,60,98,29,20,F0,03,E6
1126 DATAFE,60,E6,FC,60,EA,EA,EA
1128 DATAA5,F7,F0,75,CE,06,D0,AD
1130 DATA06,D0,C9,FF,D0,08,AD,10
1132 DATAD0,49,08,8D,10,D0,CE,08
1134 DATAD0,AD,08,D0,C9,FF,D0,08
1136 DATAAD,10,D0,49,10,8D,10,D0
1138 DATAAD,1B,D4,D0,3A,A9,04,85
1140 DATAF4,AD,10,D0,29,08,F0,08
1142 DATAAD,06,D0,18,C9,38,B0,27
1144 DATAAD,06,D0,4A,4A,4A,18,69
1146 DATAA0,85,F3,90,02,E6,F4,AD
1148 DATA10,D0,29,08,F0,0B,A5,F3
1150 DATA18,69,20,85,F3,90,02,E6
1152 DATAF4,A0,00,A9,20,91,F3,AD
1154 DATA10,D0,29,08,F0,0B,AD,06
1156 DATAD0,29,80,F0,04,A9,FF,85
1158 DATAF7,4C,60,49,EA,EA,EA,EA
1160 DATA78,A9,40,8D,15,03,A9,00
1162 DATA8D,14,03,A9,81,8D,1A,D0
1164 DATAA9,00,8D,0E,DC,8D,0E,DD
1166 DATAA9,18,8D,18,D0,A9,D8,8D
1168 DATA16,D0,A9,00,8D,21,D0,8D
1170 DATA20,D0,A9,00,85,A8,A9,28
1172 DATA85,A9,A0,00,A9,00,91,A8
1174 DATA88,D0,FB,E6,A9,A5,A9,C9
1176 DATA40,D0,F1,A2,00,8A,9D,00
1178 DATA04,9D,00,05,9D,00,06,9D
1180 DATA00,07,CA,D0,F1,AD,11,D0
1182 DATA29,7F,8D,11,D0,A9,A7,8D
1184 DATA12,D0,AD,19,D0,09,81,8D
1186 DATA19,D0,A9,01,85,F2,A9,01
1188 DATAA2,00,9D,00,D8,9D,00,D9
1190 DATA9D,00,DA,CA,D0,F4,A9,8F
1192 DATA8D,18,D4,A9,F5,8D,13,D4
1194 DATA8D,14,D4,8D,0E,D4,8D,0F
1196 DATAD4,A9,81,8D,12,D4,A9,1F
1198 DATA8D,15,D0,A9,00,A2,3F,9D
1200 DATA00,08,CA,10,FA,A9,20,8D
1202 DATAFA,07,A9,26,8D,FC,07,A9
1204 DATA27,8D,FB,07,A9,00,85,F7
1206 DATAEA,EA,EA,A9,92,8D,01,D0
1208 DATA8D,03,D0,8D,05,D0,A9,19
1210 DATA8D,10,D0,A9,02,8D,00,D0
1212 DATAA9,22,8D,02,D0,A9,B0,8D
1214 DATA04,D0,A9,0F,8D,1C,D0,A9
1216 DATA80,8D,91,02,A9,0A,8D,26
1218 DATAD0,A9,01,8D,25,D0,A9,0B
1220 DATA8D,29,D0,A9,05,8D,27,D0
1222 DATA8D,28,D0,A9,07,8D,2B,D0
1224 DATA8D,2A,D0,A9,45,8D,07,D0
1226 DATA8D,09,D0,A9,58,8D,08,D0
1228 DATAA9,70,8D,06,D0,A2,27,BD
1230 DATA00,47,9D,70,07,A9,06,9D
1232 DATA70,DB,CA,10,F2,A2,00,BD
1234 DATA00,44,9D,40,08,BD,00,45
1236 DATA9D,40,09,BD,C0,45,9D,00
1238 DATA20,BD,C0,46,9D,00,21,CA
1240 DATAD0,E5,A2,07,A9,00,95,F8
1242 DATACA,10,FB,A9,18,8D,1B,D0
1244 DATAEA,EA,EA,EA,EA,58,4C,28
1246 DATA47,EA,EA,EA,EA,AD,8D,02
1248 DATA29,04,F0,09,A5,C5,C9,31
1250 DATAD0,03,4C,E5,47,4C,B8,49
1252 DATAA9,13,A2,04,9D,19,47,CA
1254 DATA10,FA,4C,80,42,00,00,EA
1256 DATA0F,FF,C0,3F,FF,F0,05,55
1258 DATA40,05,55,40,06,56,40,06
1260 DATA56,40,05,65,40,05,65,40
1262 DATA05,55,40,06,56,40,05,A9
1264 DATA40,15,55,50,55,55,54,55
1266 DATA55,54,55,65,54,55,55,54
1268 DATA65,55,64,65,65,64,65,55
1270 DATA64,65,55,64,55,55,54,00
1272 DATA00,00,00,00,00,00,00,00
1274 DATA00,00,00,00,00,00,00,00
```

A SNOWMAN




```
1276 DATA00,00,00,00,00,00,00,00
1278 DATA00,00,00,00,00,00,00,00
1280 DATA00,00,00,00,A0,00,0A,AA
1282 DATAAA,AA,AA,AA,AA,BE,AA,BE
1284 DATAFF,AA,FF,FF,AA,FF,FF,AA
1286 DATAFF,F7,00,F7,37,00,37,00
1288 DATA00,00,00,00,00,00,00,00
1290 DATA00,00,00,00,00,00,00,00
1292 DATA00,00,00,00,00,00,00,00
1294 DATA00,00,00,00,00,00,00,00
1296 DATA00,00,00,00,A0,00,0A,AA
1298 DATAAA,AA,AA,AA,AA,BE,AA,BE
1300 DATAFF,AA,FF,FF,AA,FF,FF,AA
1302 DATAFF,DF,00,DF,1F,00,1F,00
1304 DATA00,00,00,00,00,00,00,00
1306 DATA00,00,00,00,00,00,00,00
1308 DATA00,00,00,00,00,00,00,00
1310 DATA00,00,00,00,00,00,00,00
1312 DATA00,00,00,00,A0,00,0A,AA
1314 DATAAA,AA,AA,AA,AA,BE,AA,BE
1316 DATAFF,AA,FF,DF,AA,DF,DF,AA
1318 DATADF,FF,00,FF,3F,00,3F,00
1320 DATA00,00,00,00,00,00,00,00
1322 DATA00,00,00,00,00,00,00,00
1324 DATA00,00,00,00,00,00,00,00
1326 DATA00,00,00,00,00,00,00,00
1328 DATA00,00,00,00,A0,00,0A,AA
1330 DATAAA,AA,AA,AA,AA,BE,AA,BE
1332 DATAFF,AA,FF,F7,AA,F7,F7,AA
1334 DATAF7,FF,00,FF,3F,00,3F,00
1336 DATA00,00,00,00,00,00,22,00
1338 DATA00,14,00,00,26,00,00,19
1340 DATA00,00,38,00,00,6C,00,00
1342 DATAFE,0F,80,FF,FF,C0,1F,FF
1344 DATAE0,0F,FF,E0,07,FF,E0,07
1346 DATAFF,71,07,FC,73,05,81,33
1348 DATA05,81,B3,05,01,63,0B,02
1350 DATA43,1A,04,C1,06,01,80,00
1352 DATA00,00,00,00,00,00,00,00
1354 DATA00,00,0F,D0,00,3F,D0,00
1356 DATAFF,00,00,54,00,00,A6,60
1358 DATA00,96,6E,00,55,5E,00,7E
1360 DATA6E,04,FE,6E,87,FE,BA,A7
1362 DATAFE,BA,41,57,FE,03,FE,BA
1364 DATA07,77,76,0F,BB,BA,A7,77
1366 DATA78,AA,AA,A8,0A,AA,A0,00
1368 DATA00,00,00,00,00,00,00,00
1370 DATA00,00,00,00,00,00,06,00
1372 DATA00,00,00,18,00,00,00,00
1374 DATA00,00,00,00,C0,00,00,00
1376 DATA00,00,60,00,00,00,00,00
1378 DATA00,00,00,00,00,00,30,00
1380 DATA60,00,00,00,00,00,00,00
1382 DATA00,30,00,00,00,00,00,00
1384 DATA00,00,00,00,00,60,00,00
1386 DATA00,C0,00,00,00,00,00,00
1388 DATA00,00,00,03,00,00,10,00
1390 DATA00,00,00,00,00,00,00,03
1392 DATA18,00,00,00,00,00,00,00
1394 DATA00,00,0C,00,00,00,00,00
1396 DATA00,00,00,60,00,00,00,00
1398 DATA00,00,00,00,18,00,00,00
1400 DATA00,00,07,07,00,00,00,00
1402 DATA03,03,03,06,06,1C,18,18
1404 DATA30,70,30,18,18,0C,06,06
1406 DATA00,7C,FE,C6,C6,C6,FE,7C
1408 DATA00,18,38,18,18,18,18,3C
1410 DATA00,7C,FE,06,0E,30,FE,7C
1412 DATA00,7C,FE,06,1E,06,FE,7C
1414 DATA00,60,60,6C,7E,0C,0C,0C
1416 DATA00,7C,FE,C0,FC,06,FE,7C
1418 DATA00,7C,FE,C0,FC,C6,FE,7C
1420 DATA00,7C,FE,0C,0C,18,18,18
1422 DATA00,7C,FE,C6,FE,C6,FE,7C
1424 DATA00,7C,FE,C6,FE,06,FE,7C
1426 DATA00,C6,C6,C6,FE,C6,C6,C6
1428 DATA00,18,3C,18,18,18,3C,18
1430 DATA00,7C,FE,18,18,18,18,18
1432 DATAEF,EF,00,EF,EF,00,00,00
1434 DATA00,C6,EE,FE,D6,C6,C6,C6
1436 DATA00,FC,FE,C0,F0,C0,FE,FC
1438 DATA00,7C,FE,C0,7C,06,FE,7C
1440 DATA00,C6,E6,F6,D6,DE,CE,C6
1442 DATA00,7C,FE,C6,C6,C6,FE,7C
1444 DATA00,C6,C6,D6,D6,FE,FE,7C
1446 DATA00,7C,FE,C0,C0,C0,FE,7C
1448 DATA00,23,24,25,26,00,13,13
1450 DATA13,13,13,00,1F,1E,21,22
1452 DATA00,14,15,13,13,00,23,27
1454 DATA00,13,13,13,13,13,00,1D
1456 DATA1E,00,13,13,13,13,13,00
1458 DATAA2,04,A5,FC,F0,15,C6,FC
1460 DATAFE,76,07,BD,76,07,C9,1D
1462 DATAD0,EE,A9,13,9D,76,07,CA
1464 DATA4C,30,47,A2,02,A5,FB,F0
1466 DATA15,C6,FB,FE,76,07,BD,76
1468 DATA07,C9,1D,D0,EE,A9,13,9D
1470 DATA76,07,CA,4C,4B,47,AD,76
1472 DATA07,38,E9,13,85,FA,0A,0A
1474 DATA0A,18,65,FA,18,65,FA,18
1476 DATA6D,77,07,38,E9,13,85,FA
1478 DATA0A,18,65,FA,85,FA,A9,3F
1480 DATA38,E5,FA,AA,A0,02,BD,40
1482 DATA08,9D,00,08,E8,E0,40,D0
1484 DATAF5,A2,03,A5,FE,F0,15,C6
1486 DATAFE,FE,89,07,BD,89,07,C9
1488 DATA1D,D0,EE,A9,13,9D,89,07
1490 DATACA,4C,99,47,A5,F7,D0,2B
1492 DATAA5,F9,D0,27,EA,EA,EA,A5
1494 DATAF8,D0,24,AD,1B,D4,18,C9
1496 DATA01,B0,18,A9,58,8D,08,D0
1498 DATAA9,70,8D,06,D0,AD,10,D0
1500 DATA29,07,09,18,8D,10,D0,A9
1502 DATAFF,85,F7,A9,80,85,F8,C6
1504 DATAF8,A5,F9,F0,43,A9,00,85
1506 DATAF2,85,F7,A5,FF,D0,02,E6
1508 DATAFF,20,9F,FF,A5,C5,EA,C9
1510 DATA01,D0,F6,A9,14,8D,11,47
1512 DATAA9,15,8D,12,47,A2,00,BD
1514 DATA89,07,18,DD,92,07,90,15
1516 DATAD0,08,E8,E0,05,D0,F0,4C
1518 DATA25,48,A2,04,BD,89,07,9D
1520 DATA22,47,CA,10,F7,4C,F0,43
1522 DATA4C,DD,43,B8,49,60,17,B5
1524 DATA19,1E,1A,9C,1C,31,1D,DF
1526 DATA1F,A5,21,87,23,86,25,A2
1528 DATA27,DF,2A,3E,2C,C1,2F,6B
1530 DATA32,3C,35,39,38,63,3B,BE
1532 DATA3F,4B,43,0F,47,0C,4B,45
1534 DATA4F,BF,54,7D,59,83,5E,D6
1536 DATAFF,00,64,00,00,02,00,00
1538 DATA00,00,A9,10,00,08,00,00
1540 DATA00,00,22,34,75,10,75,00
1542 DATA00,00,02,34,00,77,FF,00
1544 DATA24,02,24,02,24,02,26,02
1546 DATA24,02,24,02,1F,04,21,02
1548 DATA1F,02,21,02,23,02,24,04
1550 DATA24,04,24,02,24,02,24,02
1552 DATA26,02,24,02,24,02,1F,04
1554 DATA21,02,1F,02,21,02,23,02
1556 DATA24,04,24,04,2B,02,29,02
1558 DATA28,02,26,02,28,02,26,02
1560 DATA24,04,21,02,1F,02,21,02
1562 DATA23,02,24,04,24,04,1F,02
1564 DATA1F,02,21,02,23,02,24,02
1566 DATA24,02,26,04,2B,02,29,02
1568 DATA28,02,26,02,24,04,29,04
1570 DATA24,08,22,02,26,03,26,01
1572 DATA24,02,22,02,27,02,27,02
1574 DATA26,02,24,02,26,02,29,02
1576 DATA29,02,28,02,29,06,26,02
1578 DATA2B,03,29,01,27,02,26,02
1580 DATA24,02,22,02,21,02,26,02
1582 DATA24,02,22,02,22,02,21,02
1584 DATA22,06,FF,02,FF,02,26,02
1586 DATA24,02,26,02,29,02,29,02
1588 DATA28,02,29,06,26,02,2B,03
1590 DATA29,01,27,02,26,02,24,02
1592 DATA22,02,21,02,26,02,24,02
1594 DATA22,02,22,02,21,02,22,06
1596 DATAFF,FF,FF,FF,FF,FF,FF,FF
1598 DATAFF,FF,DF,FF,FF,EB,FF,86
1600 DATAA0,00,C6,ED,10,4F,A5,EE
1602 DATA18,69,02,85,EE,90,02,E6
1604 DATAEF,B1,EE,10,0B,A9,48,85
1606 DATAEF,A9,80,85,EE,4C,71,49
1608 DATA0A,A0,8C,04,D4,8C,0B,D4
1610 DATABD,00,48,8D,01,D4,49,8D
1612 DATA08,D4,BD,01,48,8D,00,D4
1614 DATA8D,07,D4,A9,7B,8D,05,D4
1616 DATA8D,0C,D4,A9,21,8D,04,D4
1618 DATAA9,25,8D,0B,D4,C8,B1,EE
1620 DATA0A,0A,0A,85,ED,4C,9F,FF
1622 DATAAD,76,07,C9,15,D0,07,AD
1624 DATA77,07,C9,14,F0,03,4C,28
1626 DATA47,CE,12,47,AD,12,47,C9
1628 DATA12,D0,06,CE,11,47,EE,12
1630 DATA47,A0,03,98,AA,BD,81,07
1632 DATA18,7D,89,07,38,E9,13,9D
1634 DATA89,07,18,C9,1D,90,10,38
1636 DATAE9,0A,9D,89,07,CA,FE,89
1638 DATA07,BD,89,07,4C,EA,49,88
1640 DATA10,D9,A2,04,BD,89,07,9D
1642 DATA19,47,CA,10,F7,4C,88,42
1644 DATA*
```



TOADS

Graham Lynas leaps into fast-moving action.

VIC TOAD LOADS in four programs and program 1 loads in program 2, 3 and 4 and displays a small title. Program 2 simply relocates the memory to allow for both machine code and graphics. Program 3 loads in the machine code and the graphics for the game. The graphics are held between locations 7168 and 7679 and between 6144 and 6359. There are a number of machine-code routines incorporated in the game.

The machine code held between locations: 6400-6534 scroll the logs on the screen; 5120-5180 scans the screen for the toad and dumps its location in locations 7678 and 7679; 673-730 scans both the keyboard and joystick and dumps the direction you wish to move in, in locations 0 and 1; 7088-7155 is an interrupt which is updated every 1/60th of a second.

The interrupt controls the majority of the sound in the program, making the game very noisy. Program 3 also changes the shape of the screen and displays titles while loading in program 4.

Program 4 is the game. You are the toad at the base of the screen and your objective is to reach the top of the screen. The faster you achieve this the more bonus points you are awarded. If you take too long then no bonus points are awarded.

You also receive points for travelling up the lift, jumping on logs and reaching the top of the screen.

Use the following keys:

W to go up.
X to go down.
A to go left.
D to go right.

The game is very fast and noisy and it may be a while before you reach the top of the screen, although it doesn't take long to pick up the idea of the game. The game has a number of stages. For example, each time you reach the top of the screen the logs get smaller and, after a while when you really get good at it, the ladders between the logs become invisible.

When you reach the invisible ladders stage — if you reach the invisible ladders stage — then the ladders will begin to flash and will continue to do so until you start to move. This should give you all the time you need to remember where the ladders are, but

Program 1.

```
10 POKE36879,12
20 POKE646,1
30 PRINTCHR$(147)
40 A$="LΓ:R ⁄:LΓ:R ⁄:":X=631
45 POKE198,12
50 FORY=1TOLEN(A$)
60 IFMID$(A$,Y,1)=":"THENPOKEX,13:GOTO80
70 POKEX,ASC(MID$(A$,Y,1))
80 X=X+1:NEXT
90 PRINT"▮▮▮▮▮▮▮▮▮          THE TOAD"
100 PRINT"▮▮              BY"
110 PRINT"▮▮        GRAHAM LYNAS"
120 POKE646,0
```

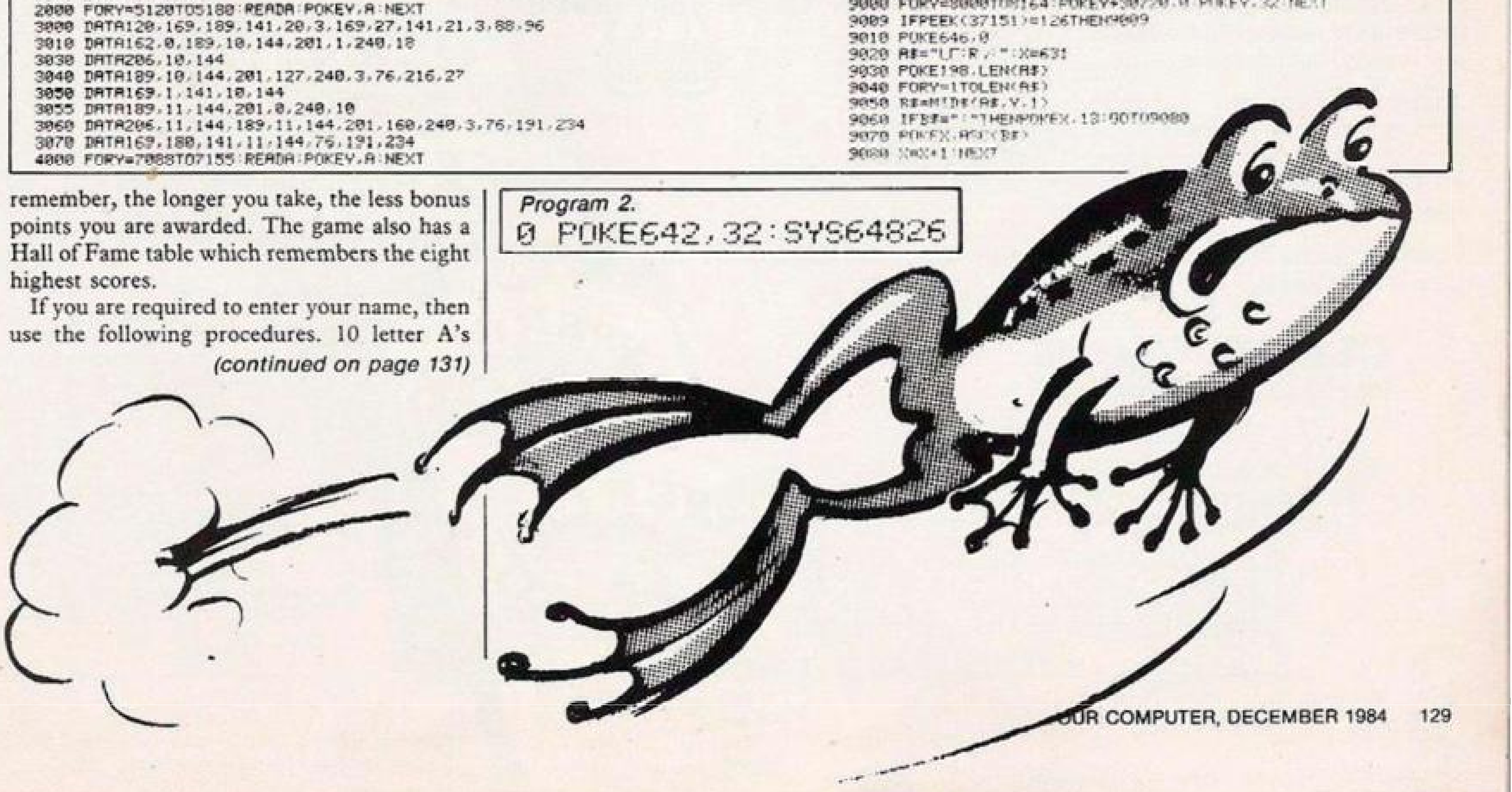
```
Program 3.
0 POKE648,30
1 POKE37148,26
3 FORY=7168TO7679:POKEY,0:NEXT:FORY=6144TO6152:POKEY,0:NEXT
4 FORY=6152TO6400:POKEY,PEEK(Y+26624):NEXT:GOSUB200:CLR
5 X=7271-7168
10 FORY=7168TO7168+X
20 READT:POKEY,T:NEXT
30 FORY=7168+8*13TO7168+511:POKEY,PEEK(Y+25600):NEXT
40 DATA162,0,232,189,22,30,157,21,30,224
41 DATA22,240,3,76,2,25,173,22,30,141
42 DATA43,30,162,21,202,189,66,30,157,67
43 DATA30,224,0,240,3,76,24,25,173,87
44 DATA30,141,66,30,162,0,232,189,110,30
45 DATA157,109,30,224,22,240,3,76,46,25
46 DATA173,110,30,141,131,30,162,21,202,189
47 DATA154,30,157,155,30,224,0,240,3,76
48 DATA68,25,173,175,30,141,154,30,162,0
49 DATA232,189,198,30,157,197,30,224,22,240
50 DATA3,76,90,25,173,198,30,141,219,30
51 DATA162,21,202,189,8,31,157,9,31,224
52 DATA0,240,3,76,112,25,173,29,31,141,8,31,96,0,-1
53 I=6400:RESTORE
54 READA:IFA=-1THEN70
55 POKEI,A:I=I+1:GOTO54
70 REM
75 X=7168
81 READT:IFT=-1THEN300
85 POKEX,T:X=X+1:GOTO81
90 FORY=7168+8*13TO7679:POKEY,PEEK(Y+25600):NEXT
100 DATA60,66,153,189,189,153,66,60:REM LOG
101 DATA31,47,68,87,87,71,47,31,255,255,24,195,255,255,255,255
102 DATA252,254,7,251,255,255,254,252
110 DATA195,36,24,60,60,90,189,153:REM FROG
130 DATA24 ,189,90,126,60,24,36,195:REM FROG
140 DATA0,219,146,210,82,219,0,0,0,179,170,179,170,171,0,0:REM SCORE
150 DATA0,168,168,234,168,168,0,0:REM HI-
160 DATA0,149,149,149,146,210,0,0,0,108,72,109,68,108,0,0:REM LIVES
170 DATA102,126,126,102,102,126,126,102:REM LADDR
180 DATA224,128,176,164,228,4,20,7
181 DATA0,157,148,156,148,212,0,0
182 DATA0,238,138,238,40,232,0,0
183 DATA0,209,149,148,128,148,0,0
184 DATA200,168,152,168,200,168,152,168,152,168,213,255,0,0,0,0
185 DATA0,191,173,173,173,255,0,0
186 DATA0,90,60,60,60,60,90,0
187 DATA0,0,36,24,24,36,0,0
189 DATA130,84,0,68,0,84,130,0
190 DATA3,7,12,156,112,240,253,255
191 DATA0,0,0,3,5,255,255,127
192 DATA0,0,0,0,0,15,63,255
193 DATA0,0,0,128,64,255,245,255,128,90,60,62,60,90,128
194 DATA0,196,170,202,170,196,0,0,0,213,213,213,181,183,0,0
195 DATA0,48,64,112,16,36,0,0,-1
200 PRINT"J";
202 POKE646,5:POKE36869,254
205 POKE36879,12:FORY=7680TO8185:POKEY,0:NEXT
210 PRINT"@@@@@  @@@@@  @@    @@   @@@ ";
220 PRINT"   @    @   @ @   @ @   @";
230 PRINT"   @    @   @ @@@@ @   @";
240 PRINT"   @    @   @ @   @ @   @  ";
250 PRINT"   @      @@  @   @ @@@    "
275 FORY=30TO170:POKE36865,Y:NEXT
276 POKE36866,153:POKE36864,9:POKE36867,38
280 PRINT"BY"
290 PRINT"GRAHAMGLYNAS"
292 FORY=170TO38STEP-1:POKE36865,Y:NEXT
295 RETURN
300 POKE7168+8*17,255:FORY=7168+8*48TO7679:POKEY,PEEK(Y+25600):NEXT
1000 DATA169,0,141,198,0,141,0,0,141,1,0,32,0,16
1010 DATA173,197,0,201,17,240,13,201,18,240
1020 DATA15,201,26,240,17,201,9,240,19,96
1030 DATA169,1,141,1,0,96,169,1,141,0
1040 DATA0,96,169,22,141,0,0,96,169,22
1050 DATA141,1,0,96
1060 FORY=673TO730:READA:POKEY,A:NEXT
1100 DATA162,0,169,0,141,255,29,141,254,29,189,0,30,201,5
1110 DATA240,41,238,255,29,232,224,255,240,3,76,10,20
1120 DATA162,0,169,255,141,255,29,169,0,141,254,29,189,255,30,201,5
1130 DATA240,12,238,254,29,232,224,255,240,3,76,40,20
1140 DATA96,96,96
2000 FORY=5120TO5180:READA:POKEY,A:NEXT
3000 DATA120,169,189,141,20,3,169,27,141,21,3,88,96
3010 DATA162,0,189,10,144,201,1,240,18
3030 DATA206,10,144
3040 DATA189,10,144,201,127,240,3,76,216,27
3050 DATA169,1,141,10,144
3055 DATA189,11,144,201,0,240,10
3060 DATA206,11,144,189,11,144,201,160,240,3,76,191,234
3070 DATA169,180,141,11,144,76,191,234
4000 FORY=7088TO7155:READA:POKEY,A:NEXT
4010 DATA169,127
4012 DATA141,34,145,173,32,145
4014 DATA141,3,0,169,255,141,34,145,173,3,0
4016 DATA41,128,201,0,208,6
4018 DATA169,1,141,0,0,96
4020 DATA173,31,145,41,8
4022 DATA201,0,208,6
4023 DATA169,22,141,0,0,96
4024 DATA173,31,145,41,16
4025 DATA201,0,208,6
4026 DATA169,1,141,1,0,96
4027 DATA173,31,145,41,4
4028 DATA201,0,208,5
4029 DATA169,22,141,1,0,96
5000 FORY=4096TO4171:READA:POKEY,A:NEXT
5005 DATA0,0,0,0,0,0,0,0
5010 REM  (A)
5011 DATA24,60,102,126,126,102,231,0
5020 REM  (B)
5021 DATA252,254,38,60,38,254,252,0
5030 REM  (C)
5031 DATA28,62,98,96,98,62,28,0
5040 REM  (D)
5041 DATA248,252,38,38,38,252,248,0
5050 REM  (E)
5051 DATA254,252,96,120,96,252,254,0
5060 REM  (F)
5061 DATA254,252,96,120,112,96,96,0
5070 REM  (G)
5071 DATA28,62,96,110,102,62,28,0
5080 REM  (H)
5081 DATA102,102,126,126,102,102,102,0
5090 REM  (I)
5091 DATA60,60,24,24,24,60,60,0
5100 REM   (J)
5101 DATA30,30,12,12,76,124,56,0
5110 REM   (K)
5111 DATA102,108,120,112,120,108,102,0
5120 REM   (L)
5121 DATA96,96,96,96,96,254,254,0
5130 REM   (M)
5131 DATA66,102,126,126,102,102,102,0
5140 REM   (N)
5141 DATA102,118,118,126,110,110,102,0
5150 REM   (O)
5151 DATA24,60,102,102,102,60,24,0
5160 REM   (P)
5161 DATA124,126,102,124,120,96,96,0
5170 REM   (Q)
5171 DATA24,60,102,106,110,62,31,1
5180 REM   (R)
5181 DATA252,254,102,124,120,108,102,0
5190 REM   (S)
5191 DATA60,126,96,126,2,126,60,0
5200 REM   (T)
5201 DATA126,126,90,24,24,24,60,0
5210 REM   (U)
5211 DATA102,102,102,102,126,126,60,0
5220 REM   (V)
5221 DATA195,195,102,102,60,60,24,0
5230 REM   (W)
5231 DATA102,102,102,126,126,102,66,0
5240 REM   (X)
5241 DATA102,102,60,24,24,60,102,102
5250 REM   (Y)
5251 DATA102,102,102,60,24,24,24,0
5260 REM   (Z)
5261 DATA126,126,6,60,96,126,126,0
6000 FORY=6144TO6359:READA:POKEY,A:NEXT
7000 FORY=7552TO7631
7010 READA:POKEY,A:NEXT
7020 DATA60,126,102,102,102,126,60,0
7030 DATA24,56,56,24,24,126,126,0
7040 DATA60,126,14,60,112,124,126,0
7050 DATA124,126,6,28,6,126,124,0
7060 DATA96,96,108,108,126,126,12,0
7070 DATA126,126,96,124,6,62,60,0
7080 DATA28,60,96,124,102,102,60,0
7090 DATA126,126,12,24,48,48,48,0
7100 DATA60,126,102,60,102,126,60,0
7110 DATA60,126,102,62,6,60,56,0
9000 FORY=8000TO8164:POKEY+30720,0:POKEY,32:NEXT
9009 IFPEEK(37151)=126THEN9009
9010 POKE646,0
9020 A$="LT:R,:":X=631
9030 POKE198,LEN(A$)
9040 FORY=1TOLEN(A$)
9050 B$=MID$(A$,Y,1)
9060 IFB$=":"THENPOKEX,13:GOTO9080
9070 POKEX,ASC(B$)
9080 X=X+1:NEXT
```

remember, the longer you take, the less bonus points you are awarded. The game also has a Hall of Fame table which remembers the eight highest scores.

If you are required to enter your name, then use the following procedures. 10 letter A's

(continued on page 131)

```
Program 2.
0 POKE642,32:SYS64826
```



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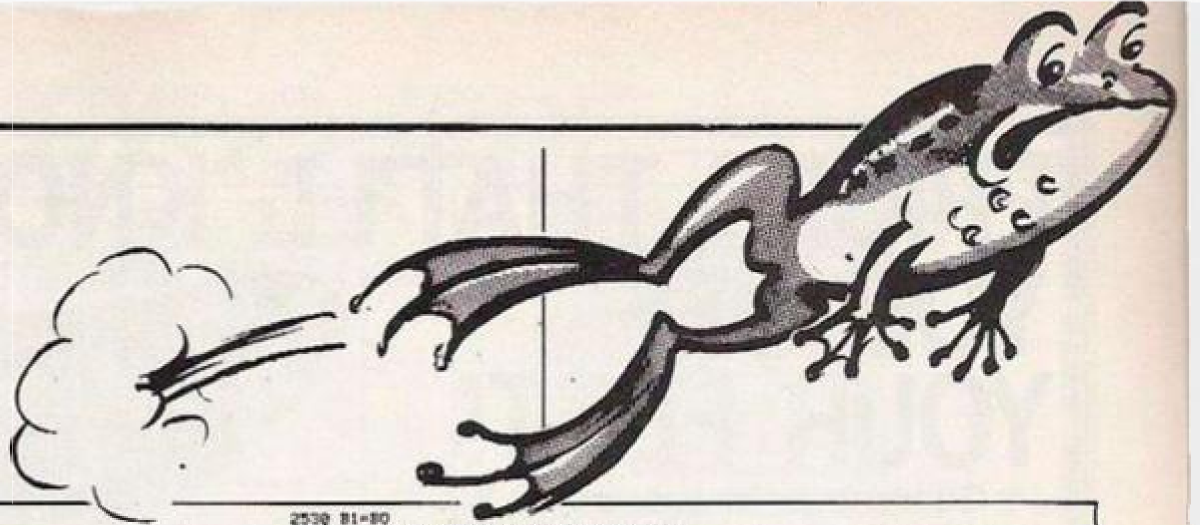
(continued from page 129)

will be displayed on the screen. Position your toad under the letter you wish to change, using the keys A and D or left and right on the joystick.

When you are ready to enter your name press S on the keyboard or fire button on the joystick. The game occupies asbout 7K and could probably run with 8K expansion although it was designed to run with 16K expansion.



Program 4.

```
0 B=1:LI=5:R4=1:POKE648,30:W=100:SO=36876:POKESO+2,15:POKE7142,150:POKE7149,200
1 S9=36875:S8=S9-1:SYS7088:POKES8,0:POKES9,255
4 S9=36875:S8=S9-1:SYS7088:POKES8,0:POKES9,255
5 DEFFNR(X)=INT(RND(1)*X):IFTR=0THENGOSUB4000:POKE36867,0
6 POKE36879,8:P3=8175:P4=230:P5=5
10 POKE648,30:PRINT"▒"
11 GOTO20
12 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒FO"SC"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒IJ"LI"▒"
13 IFIP=9THENPOKES8,0:RETURN
14 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒FO▒▒▒▒"HS"▒"
15 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"BO"▒ ":POKES8,0
16 RETURN
20 C=30720:P=7680
21 C(1)=1:FORY=2TO4:C(Y)=2:NEXT:C(5)=3
30 R(1)=(P+22)+5:R(2)=(P+22*4)-6:R(3)=(P+22*5)+2:R(4)=(P+22*8)-15:R(5)=(P+22*9)+
12
31 R(6)=(P+22*12)+7
32 FORY=1TO7:S(Y)=200+V:V=V+7:NEXT:V=0
35 POKE36869,255
40 D=4:S=1
41 FORY=PTOP+21:POKEY,230:POKEY+C,5:NEXT
42 FORY=8164TO8180:POKEY,230:POKEY+C,5:NEXT
43 FORY=8043TO8048:POKEY,230:POKEY+C,5:NEXT
44 FORY=8042TO8042+66STEP22:POKEY,11:POKEY+C,2:NEXT
45 FORY=8104TO8107:POKEY,230:POKEY+C,5:NEXT:FORY=8103TO8103-88STEP-22:POKEY,11:P
OKEY+C,2
46 NEXT:POKE8016,230:POKE8016+C,5:FORY=8017TO8017-44STEP-22:POKEY,11:POKEY+C,2:N
EXT
47 POKE8014,230:POKE8014+C,5:FORY=8013TO8013-44STEP-22:POKEY,11:POKEY+C,2:NEXT:G
OSUB50
48 GOTO55
50 Z=6
51 R(1)=(7707+23)+FNR(Z):R(2)=(7762+21)-FNR(Z)
52 R(3)=(7792+23)+FNR(Z):R(4)=(7841+21)-FNR(Z)
53 R(5)=7890+22+FNR(Z):R(6)=R(5)+22
54 RETURN
55 FORY=1TO6:POKER(Y),11:POKER(Y)+C,2:NEXT
56 E=3:GOSUB59:GOTO80
59 FORT=1TO6
60 FORY=R(T)TOR(T)+E
70 POKEY,C(B):B=B+1:NEXT:B=1:POKEY+C,5
71 IFGR=9THENPOKEY,32:POKEY-1,0
72 NEXT:GOSUB2000
75 RETURN
80 D(1)=8181:FORY=2TO10:D(Y)=D(Y-1)-22:NEXT
85 FORY=1TO9:POKED(Y)+1,16:POKED(Y)+1+C,3:NEXT:G=1
86 FORY=0TO46STEP2:POKE36867,Y:NEXT
89 POKES9,0:TI$="000000":GOTO100
90 POKED(G),32:G=G+1:IFG=9THENG=1:IFPEEK(D(9))=5THEN8000
91 IFPEEK(D(G))<>5THEN94
92 POKED(G+1),PEEK(D(G)):P3=P3-22:POKES9,S(G):SC=SC+2:IP=9
93 POKED(G),17:GOSUB12:GOTO99
94 POKED(G),17
99 RETURN
100 POKEP3,5:POKEP3+C,1:S=-1:GOSUB12:POKE36865,30
110 GOSUB90:SYS6400:SYS673:IP=0
111 IFPEEK(P3)<>5THENSYS5120:P3=7680+PEEK(7679)+PEEK(7678)
120 D=PEEK(0)-PEEK(1):IFD=0THEN110
122 IFP3+D>8185THEND=0:GOTO110
123 POKES8,0
130 POKEP3,P4:POKEP3+C,P5:R4=1:IFP3<=7701THEN1000
140 P3=P3+D:O=0
141 P4=PEEK(P3):P5=PEEK(P3+C)
142 IFP3=D(1)ANDP4<>17THEN100
143 IFP4=32ORP4=17ORP4=16THEN8000
145 IFP4<5THENR4=P5:O=9:IFD=-22THENSC=SC+10:POKES9,255:IP=9:GOSUB12:IP=0
170 POKEP3,5:POKEP3+C,R4:GOTO110
1000 FORX=1TO45STEP10:FORY=1TO8:POKESO,S(Y):NEXT:FORT=200-XTO160STEP-1:POKESO,T
1001 NEXT:NEXT:LI=LI+2:MT=VAL(TI$):IFLI>9THENLI=9
1002 POKES9,149:POKESO,0:IFMT>WTHENMT=W
1003 FORY=0TOW-1:SC=SC+1:PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒FO"SC"▒":POKES8,0:NEXT
1005 IFSC>HSTHENHS=SC:GOSUB14:POKESO+1,255:POKESO+1,0:POKES8,0
1006 POKESO,230:POKESO,0
1007 GOSUB2500
1008 IFSC>HSTHENHS=SC:GOSUB14:POKESO+1,255:POKESO+1,0
1010 W=W+10:GOSUB12:POKESO+1,128:POKESO,0:POKESO+1,0
1011 FORY=1TO6:POKER(Y),32:POKER(Y)+C,2:NEXT
1012 GOSUB50
1014 FORY=1TO6:POKER(Y),11:POKER(Y)+C,2:NEXT
1020 P3=8175:POKESO,0:POKESO+1,0:TI$="000000"
1021 FORY=1TO10STEP2
1022 FORX=P+22*YTOP+22*Y+21:POKEX,32:NEXTX,Y
1023 FORY=P+(22*12)TOP+(22*12)+21:POKEY,32:NEXT
1030 E=E-1
1040 IFE=4THENGOSUB59:GOTO9000
1050 IFE=3THENGOSUB59:GOTO9000
1060 IFE=2THENGOSUB59:GOTO9000
1070 IFE=1THENGOSUB59:GOTO9000
1080 IFE=0THENGR=9:GOSUB59:GR=0:GOTO9000
1090 IFE=-1THENE=3:GOSUB59:E=-1:GOTO3000
1100 IFE=-2THENE=2:GOSUB59:E=-2:GOTO3000
1110 IFE=-3THENE=1:GOSUB59:E=-3:GOTO3000
1120 IFE=-4THENE=0:GR=9:GOSUB59:GR=0:E=-4:GOTO3000
1130 IFE=-5THENE=4:GOTO1030
1999 GOTO9000
2000 FORY=1TO10STEP2:R5=FNR(5)+3
2010 FORX=P+22*YTOP+22*Y+21:POKEX+C,R5:NEXTX,Y
2011 R5=FNR(5)+3
2020 FORY=P+(22*12)TOP+(22*12)+21:POKEY+C,R5:NEXT
2030 Z(1)=19:Z(2)=20:Z(3)=21:Z(4)=32
2040 FORY=1TO9:K(Y)=8172+Y:NEXT
2060 IFTR=0THENTR=99.99:GOTO2070
2065 RETURN
2070 FORY=1TO8:HS$(Y)="▒----------":HS(Y)=10:NEXT:HS=10
2080 DIMJ(17)
2090 FORY=1TO16:READA:J(Y)=A:NEXT
2110 DATA225,4,215,2,215,2,219,4,215,8,223,4,225,4,0,0
2200 O(1)=24:O(2)=23:O(3)=22:O(4)=230:O(5)=5
2205 DIMP(16)
2210 FORY=0TO16:P(Y)=8164+Y:NEXT
2370 RETURN
2500 POKESO,0:BO=(W-MT):IFBO<=0THENRETURN
2509 :FORY=1TO10
2510 POKE646,0:GOSUB15:FORX=230TO180STEP-5:POKESO-1,X:NEXT:POKESO-1,255
2515 POKE646,3:GOSUB15:FORX=180TO230STEP5:POKESO-1,X:NEXT:POKESO-1,0
2520 NEXTY
2530 B1=BO
2540 FORY=1TOB1:BO=BO-1:SC=SC+1:GOSUB15
2550 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒FO"SC"▒":POKESO,252:POKESO,0
2560 NEXTY:RETURN
3000 POKE198,0:FORY=1TO6:POKER(Y),32:POKER(Y)+C,0:NEXT
3010 GOSUB50
3020 FORY=1TO6:POKER(Y),11:POKER(Y)+C,2:NEXT
3025 POKES8,0:FORY=230TO240:POKESO,Y:NEXT:POKESO,0
3030 FORY=1TO6:POKER(Y),11:POKER(Y)+C,0:NEXT
3035 FORY=240TO220STEP-1:POKESO,Y:NEXT:POKESO,0
3040 SYS673:IFPEEK(0)-PEEK(1)=0THEN3020
3050 GOTO9000
4000 POKE198,0:PRINT"▒":POKE36869,254:POKE36879,28:POKE646,3
4001 FORY=22TO0STEP-1
4002 POKE36864,12+Y
4003 POKE36865,38+Y
4004 POKE36866,150-Y
4005 POKE36867,46-Y*2
4006 NEXT
4010 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒TOAD▒▒E"
4040 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒Y"
4050 PRINT"▒▒▒▒▒▒GRAHAM▒LYNAS"
4060 PRINT"▒▒▒▒▒COPYRIGHT▒▒1984▒"
4075 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒PRESS▒▒ANY▒KEY"
4076 GETB$:IFB$=""AND(PEEK(37151)AND32)<>0THENPOKE646,FNR(6)+2:GOTO4075
4280 POKE36869,254:PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒GOOD▒LUCK▒▒▒":POKE36874,0
4290 FORT=1TO500:NEXTT
4500 FORY=0TO22
4590 POKE36864,12+Y
4591 POKE36865,38+Y
4592 POKE36866,150-Y
4593 POKE36867,46-Y*2
4600 NEXT:POKE36869,255
4700 POKE36879,8:PRINT"▒":POKE36866,150:POKE36865,38:POKE36864,12:POKE36867,46
4800 RETURN
4999 END
6000 FORY=1TO14STEP2:POKES8,0:POKESO,J(Y):POKESO-1,J(Y):POKES9,254
6015 FORT=1TOTM*J(Y+1):NEXTT
6017 POKESO-1,0:POKESO,0:NEXT
6020 RETURN
7000 PRINT"▒▒▒▒▒▒▒▒        ▒AME OVER      "
7001 FORY=1TO6:POKER(Y),11:POKER(Y)+C,2:NEXT
7010 POKES9,255:TM=30:GOSUB6000
7015 FORY=46TO0STEP-2:POKE36867,Y:NEXT
7020 GOTO8029
8000 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒ HMO";:LI=LI-1:GOSUB12
8001 IFPEEK(P3+43)=5THENP3=P3+43:P5=PEEK(P3-21):P4=PEEK(P3-21)
8005 P5=PEEK(P3+C):FORY=1TO4:POKEP3,Z(Y):POKEP3+C,5
8010 FORX=150+Y*20TO175+Y*20:POKESO,X:NEXT:POKESO,0:NEXT
8011 POKEP3+C,P5:POKEP3,P4
8012 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒    ";:
8020 IFLI>0THEN9000
8021 GOTO7000
8029 POKE36869,240:PRINT"▒":POKE36867,46
8030 IFSC>HS(8)THENHS(8)=SC:GOTO8040
8035 GOTO8200
8040 POKE36869,254:POKE36879,25:PRINT"▒▒▒ENTER▒YOUR▒NAME▒":POKE198,0:X1=7690+18
+16*22
8041 POKE36875,255:X=1
8042 PRINT"▒▒▒▒▒▒▒▒▒AAAAAAAAAA":PRINT"▒       ----------"
8045 PRINT"▒▒▒▒▒▒▒▒▒▒THE▒TORD"
8049 PS=7840:POKEPS,133:POKEPS+C,5
8050 SYS673
8051 IFPEEK(197)=41OR(PEEK(37151)AND32)=0THENPOKE36874,0:GOTO8500
8052 IFPEEK(0)=1ANDPS<>7849THENPOKEPS,0:PS=PS+1:POKEPS,133:POKEPS+C,5:GOTO8050
8053 IFPEEK(1)=1ANDPS<>7840THENPOKEPS,0:PS=PS-1:POKEPS,133:POKEPS+C,5:GOTO8050
8054 IFPEEK(0)=22THENGOSUB8620:GOTO8050
8055 IFPEEK(1)=22THENGOSUB8600:GOTO8050
8059 IFFL=0THEN8050
8060 FL=0:HS$(8)=A$
8070 FL=0
8080 FORY=1TO7
8090 IFHS(Y)>=HS(Y+1)THEN8100
8095 FL=1:X=HS(Y):HS(Y)=HS(Y+1):HS(Y+1)=X:X$=HS$(Y):HS$(Y)=HS$(Y+1):HS$(Y+1)=X$
8100 NEXT
8110 IFFL=1THEN8070
8200 POKE36865,200:POKE36879,25
8201 POKE36869,254:PRINT"▒▒▒HIGH▒SCORE▒TABLE":PRINT"▒  ================"
8210 FORT=1TO8:PRINT"▒▒▒"T:TAB(4)"▒▒"HS$(T)TAB(15)"▒▒"HS(T):NEXT
8220 POKE190,0:POKE36865,38
8230 FORY=8164TO8185:POKEY,0:POKEY+C,6:NEXT
8250 TU=8164+4:ZC=22:POKE7149,250:POKE7142,230:POKES9,255
8260 POKETU-5,0:POKES8,200
8270 POKETU-4,24+128:POKETU-3,23+128:POKETU-2,ZC+128:POKETU-1,0:POKETU,26+128
8280 TU=TU+1:IFTU=8191THENTU=8164+4
8281 IFZC=22THENZC=25:GOTO8290
8282 ZC=22
8290 GETA$:IFA$=""AND(PEEK(37151)AND32)<>0THENFORT=1TO100:NEXTT:GOTO8260
8300 FORT=1TO300:NEXTT
8301 TU=TU-1:POKETU-4,0:POKETU-3,24+128:POKETU-2,23+128:POKETU-1,25+128:POKETU,5
+128
8302 POKES9,230
8305 FORT=1TO500:NEXTT
8306 POKESO+1,200
8310 POKETU-3,0:POKETU-2,24+128:POKETU-1,23+128:POKETU,22+128
8311 POKESO+1,220
8312 POKESO+1,0:FORT=1TO100:NEXTT
8314 POKESO+1,128:POKETU-3,0:POKETU-2,24+128:POKETU-1,23+128:POKETU,25+128
8320 POKESO+1,0
8325 FORT=1TO300:NEXTT
8326 FORY=TUTO8190:POKEY-3,0: POKEY-2,24+128:POKEY-1,23+128:POKEY,25+128
8327 FORT=1TO100:NEXTT,Y
8330 HS=HS(1):SC=0:POKES9,149:POKE7142,150:POKE7149,200
8340 FORY=46TO0STEP-2:POKE36867,Y:NEXT:GOTO0
8500 REM
8501 FORY=7840-44TO7849-44
8503 CR=PEEK(Y)+64
8504 A$=A$+CHR$(CR):NEXT
8505 GOTO8060
8600 IFPEEK(PS-44)=26THENPOKEPS-44,0:RETURN
8601 POKEPS-44,PEEK(PS-44)+1:RETURN
8602 RETURN
8620 IFPEEK(PS-44)=0THENPOKEPS-44,26:RETURN
8621 POKEPS-44,PEEK(PS-44)-1:RETURN
8622 RETURN
8662 FORY=PSTOPS+4:POKEPS,PEEK(PS)-128:NEXT:GOTO8670
8665 FORY=PSTOPS+4:POKEPS,PEEK(PS)+128:NEXT:GOTO8670
8690 RETURN
8999 END
9000 POKES9,0:P3=8175:P4=230:P5=5:GOTO100
```

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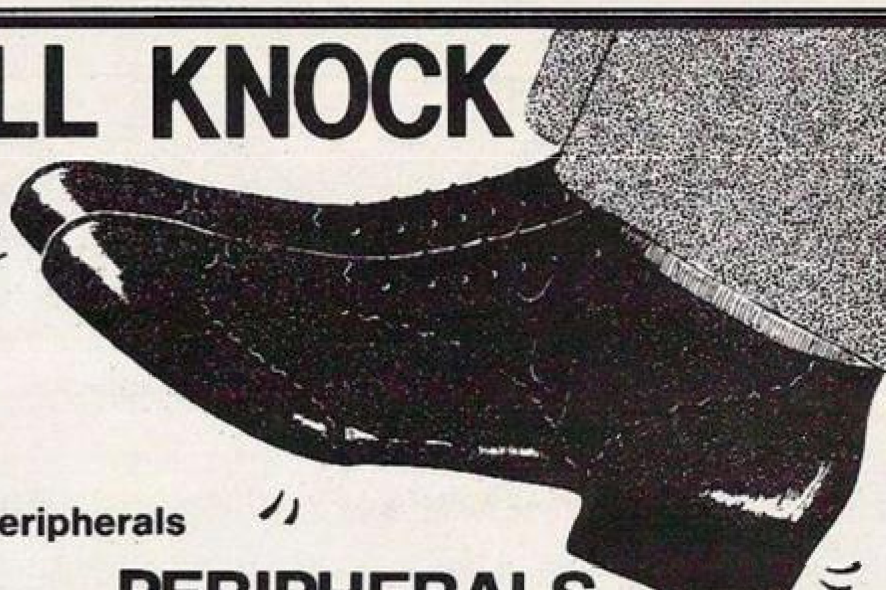

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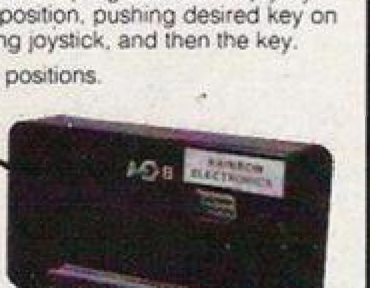

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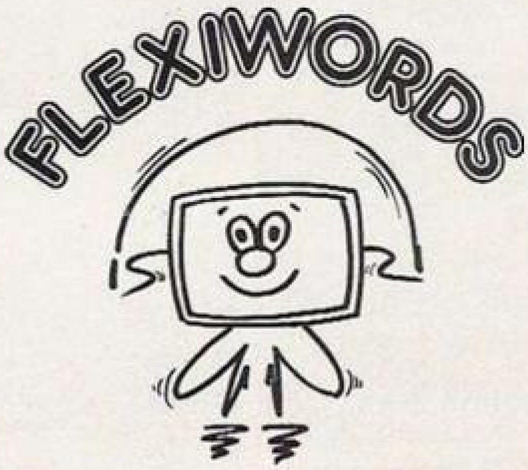

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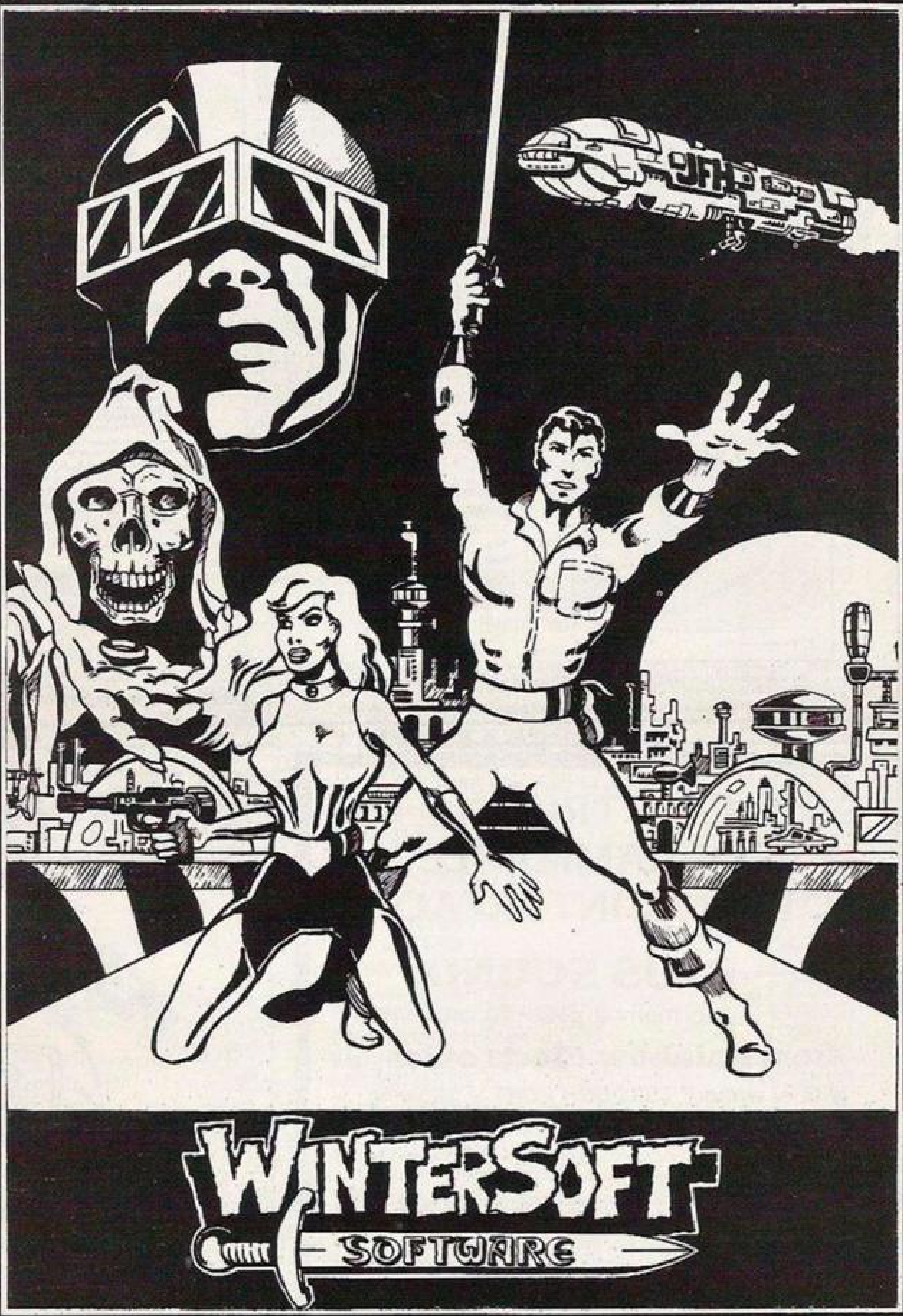

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Julian Wood and a maze game with a difference for the Spectrum.

UFO IS AN ORIGINAL game for the 16K or 48K Spectrum. It is written entirely in machine code and is therefore very fast. The general idea of the game is as follows:

You, a poor undefended human have been sent against a lethal race of aliens who follow you around the screen. The only way you can kill an alien is to collide with an energy block — the stationary object on the scren — which gives you enough power to kill one, and only one, alien. Once you have killed an alien, if you go to the bottom of the screen without hitting anything and then press the down key, the dead body of the alien will appear at the bottom of the screen.

Once the time — shown as TI at the top of the screen — reaches zero, the number of dead aliens at the bottom of the screen gives you a bonus added to your score. With each screen only a certain maximum number of aliens will appear, and once you have killed all these, another batch will appear.

After each screen the maximum number of aliens is incremented up to a maximum of 10. The keys for moving the human are:

6 = left, 7 = right, 8 = up, 9 = down, 0 = halt of the game.

To enter UFO, first type in the Basic program in listing 1, and save it using

SAVE "UFO" LINE 0

and then verify it. Next, enter the machine code loader program in listing 3, and run it. Enter the machine code as in listing 2, and the screen output should tally with the listing. If you make a mistake enter −9 and enter that line again. If you enter a ridiculous number — greater than 255 — you will hear a beep and you should enter that number again.

Once you have entered all 1663 bytes of machine code, save it using

SAVE "c" CODE 24500,1663

and verify it. Finally check that the program is OK by loading the UFO Basic program which should load and run the main program.

After playing UFO for a while you may find it too easy or hard. I have therefore shown various locations — in figure 1 — which you can change to suit your needs by Poking. The initial contents of the location are shown in brackets. To change a value of a location, just load the code, Poke the location and

RAND USR 25807

Figure 1.

Speed = 25922 (20).	Time speed = 25915 (3).
Lives = 25839 (3).	Max. number of aliens = 25689 (10).

If you are still unconvinced of how essential sound is in games, then try the following:

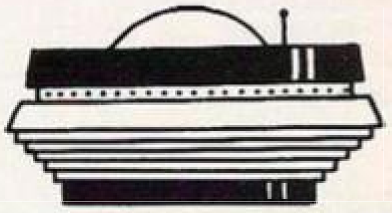
POKE 24500, 201 : POKE 25114,201.

Hear the difference?

Furthermore, try Poking 24775, 201,

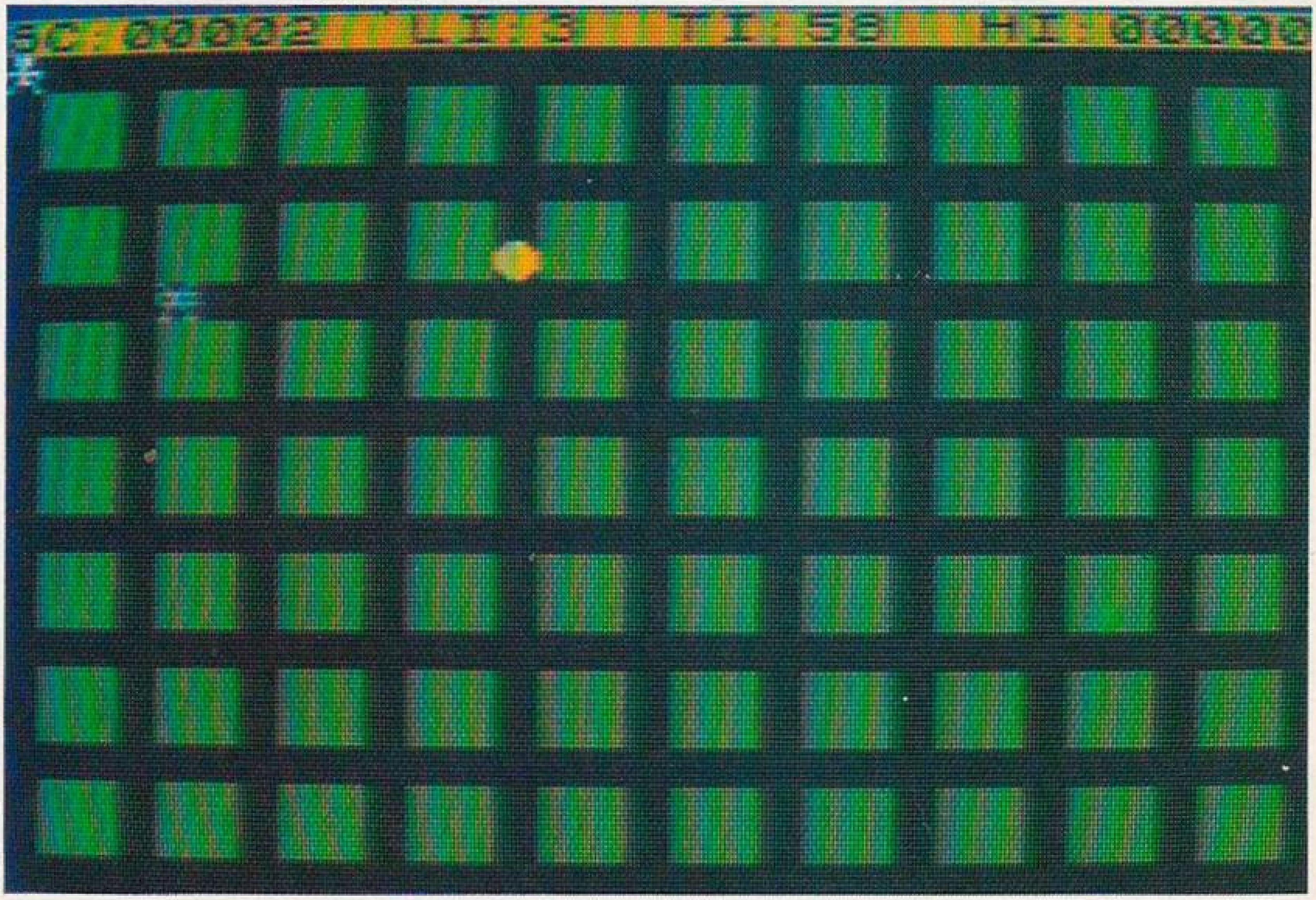
(continued on page 137)

UFOS



Listing 1.

```
  10>POKE 23697,0: POKE 23693,9:
 BORDER 1: CLS : LET a$="UFO IS
LOADING": FOR a=7 TO 0 STEP -1:
BEEP .02,a+18.5: PRINT AT 11-a,9
; INK 6;a$;AT 10-a,9,,AT a+11,9;
a$;AT a+12,9,,: BORDER a: NEXT a
  20 BEEP .5,17.5: BEEP .5,19.5:
 BEEP .5,15.5: BEEP .5,7.5: BEEP
 1,10.5: FOR a=22888 TO 22903 ST
EP 2: POKE a,178: POKE a+1,150:
NEXT a: LOAD ""CODE : RANDOMIZE
USR 25807
```



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☐ Abersoft FORTH 48K £14.95
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BC SOFTWARE

☐ BBC The Hobbit, Model B £14.95
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versions of 'The Hobbit' are identical with regard to the adventure ogram. Due to memory limitations BBC cassette version does not clude graphics.

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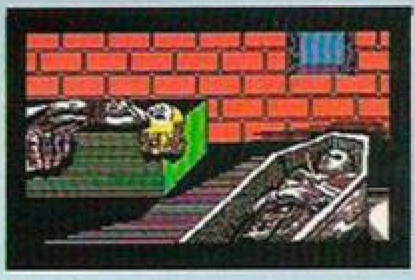


Castle Of Terror is a suberb graphic adventure game set in the 1880's when and where "Dracula" stories abounded. You are in a village near a large Castle in which the secretive Count lives. You must travel about the village, collecting items which may be of use to you on your bold mission.

You must also find out what your mission is by talking to the right people. But don't be fooled!

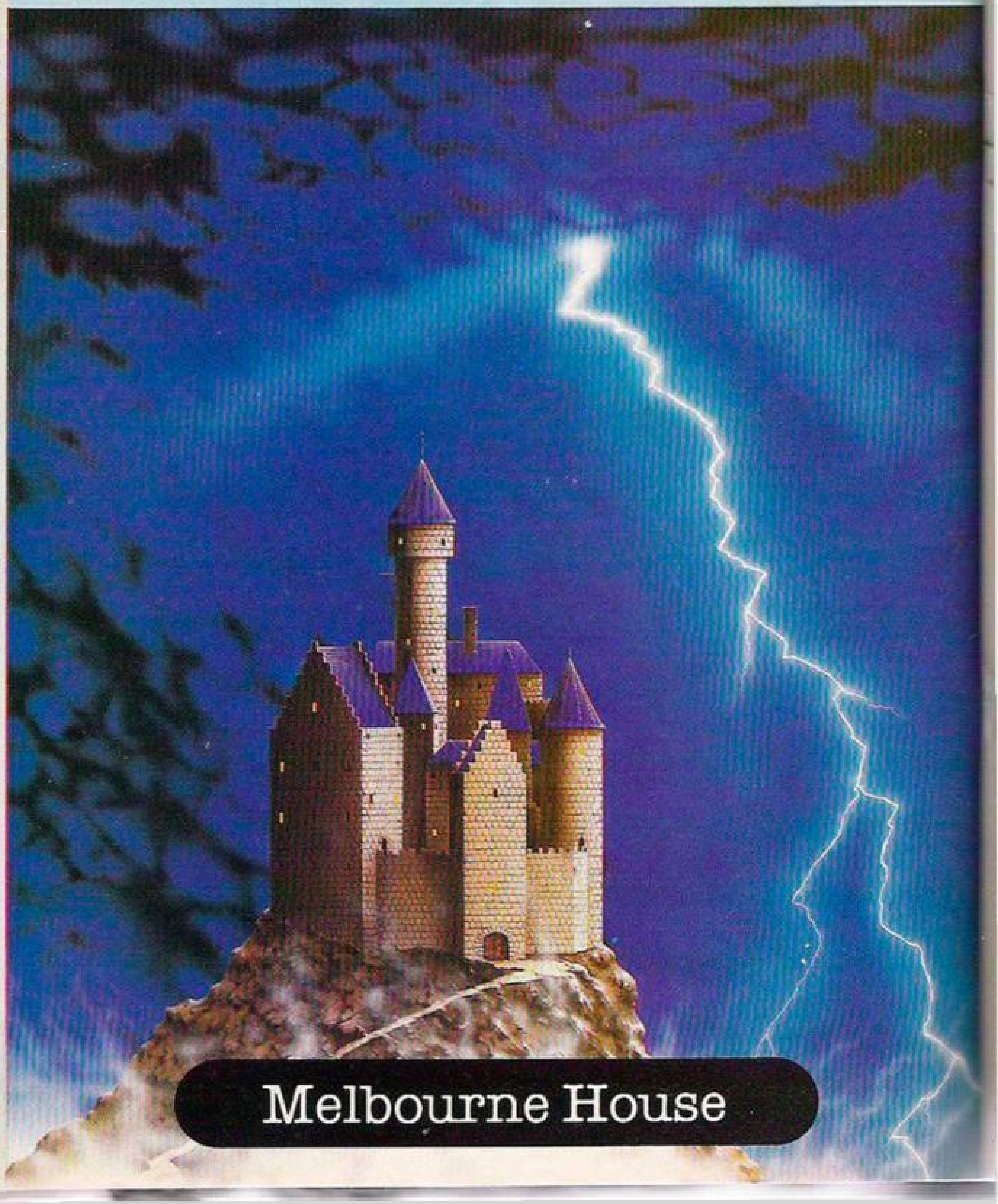
★ Multi-word "English Language" style input

★ Superb, highly detailed graphics

★ Animated characters, special effects and sound.

Surviving is success enough, but escaping with the treasure is the ultimate achievement and won't be easily accomplished!

CASTLE·of·TERROR



Melbourne House

(continued from page 135)

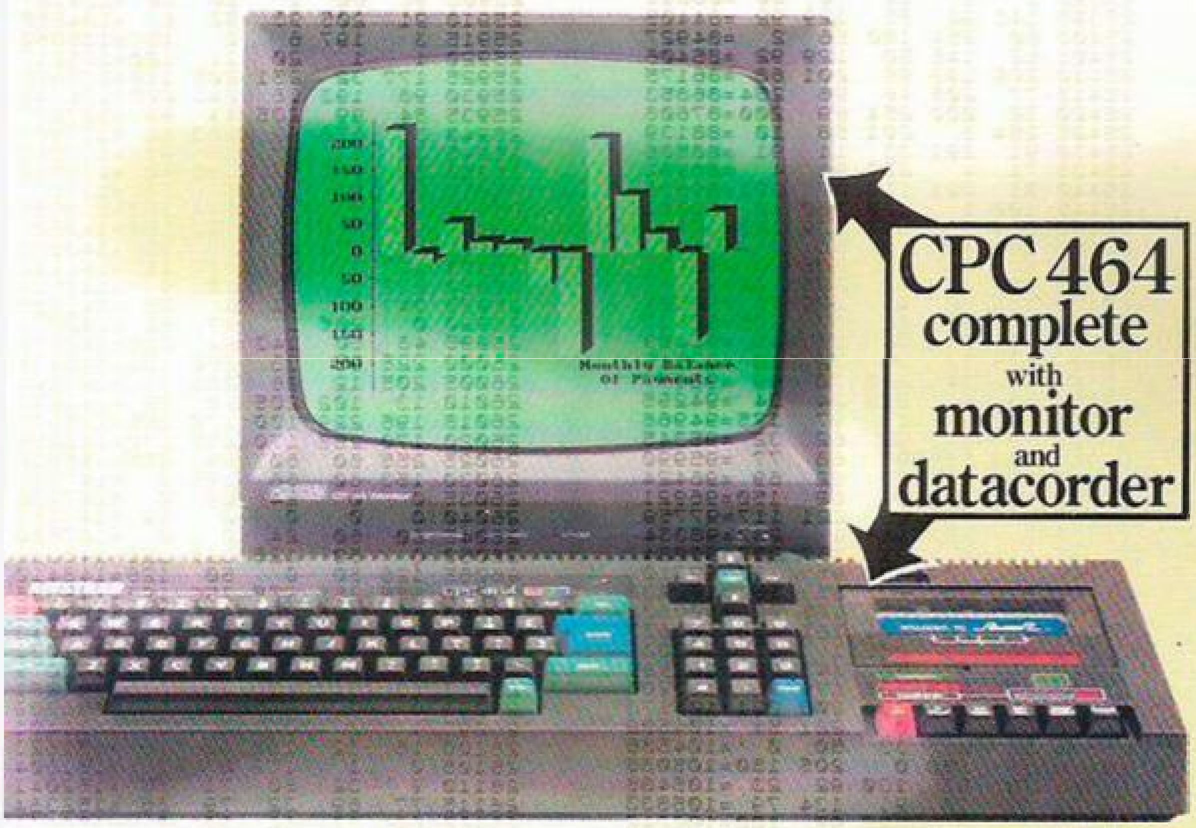
Listing 2.

```
24500:18  72  92  238 16  =475
24505:211 254 71  62  255=1329
24510:229 43  188 32  252=2073
24515:223 27  188 120 32  =2663
24520:238 201 50  72  92  =3316
24525:211 254 201 71  33  =4086
24530:0   54  62  88  54  =4354
24535:0   35  188 32  250=4859
24540:62  91  112 35  188=5347
24545:32  251 201 1   240=6072
24550:216 208 255 95  1   =6844
24555:24  252 205 255 95  =7675
24560:1   156 255 205 255=8547
24565:95  14  246 205 255=9362
24570:95  125 60  24  7   =9673
24575:175 9   60  56  252=10225
24580:237 66  198 47  205=10978
24585:199 96  201 126 35  =11635
24590:254 1   32  7   126=12055
24595:50  143 92  35  24  =12399
24600:243 254 0   32  9   =12937
24605:70  35  75  35  205=13357
24610:1   97  21  230 254=13960
24615:2   200 205 199 98  =14664
24620:24  222 197 229 104=15444
24625:38  0   41  41  41  =15605
24630:41  41  6   88  9   =15790
24635:126 225 193 201 217=16752
24640:33  121 92  78  6   =17082
24645:5   10  52  43  134=17326
24650:52  217 201 62  1   =17859
24655:205 202 95  175 205=18741
24660:208 95  33  167 96  =19340
24665:205 12  96  42  0   =19695
24670:91  205 228 95  1   =20315
24675:0   0   205 98  100=20718
24680:1   13  0   205 1   =20938
24685:97  58  8   91  205=21398
24690:252 95  33  64  88  =21927
24695:62  32  14  7   30  =22072
24700:2   6   10  35  119=22244
24705:35  119 35  16  249=22698
24710:35  35  29  32  242=23071
24715:17  32  0   25  13  =23158
24720:32  233 33  31  88  =23575
24725:6   24  54  8   25  =23692
24730:16  251 33  224 90  =24306
24735:6   31  54  86  35  =24518
24740:16  251 201 1   48  =25035
24745:0   0   0   83  67  =25185
24750:58  48  48  48  48  =25435
24755:48  32  32  78  73  =25698
24760:58  51  32  32  84  =25955
24765:73  58  57  57  32  =26230
24770:32  72  73  58  2   =26467
24775:229 197 213 237 91  =27434
24780:132 92  237 75  54  =28024
24785:92  254 144 56  6   =28576
24790:237 75  123 92  214=29317
24795:144 38  0   111 41  =29651
24800:41  41  0   122 15  =29879
24805:15  15  230 3   246=30388
24810:88  71  75  58  143=30823
24815:92  2   8   8   126=31057
24820:18  20  35  16  250=31396
24825:33  132 92  52  209=31914
24830:193 225 201 229 197=32959
24835:213 120 15  15  15  =33337
24840:230 224 177 111 120=34199
24845:230 24  248 64  103=34868
24850:34  132 92  24  230=35378
24855:62  1   205 202 95  =35943
24860:175 205 208 95  33  =36659
24865:184 97  205 12  96  =37253
24870:62  1   50  143 92  =37601
24875:33  103 97  205 12  =38051
24880:96  33  100 0   17  =38297
24885:1   0   205 180 95  =38778
24890:45  32  247 1   254=39357
24895:127 237 120 31  208=40080
24900:58  143 92  60  254=40687
24905:8   40  218 24  218=41195
24910:17  180 45  175 211=41823
24915:254 60  230 7   71  =42445
24920:33  43  0   43  124=42688
24925:181 32  251 27  122=43301
24930:179 120 32  236 201=44069
24935:0   3   9   144 32  =44257
24940:32  144 32  144 144=44753
24945:144 32  144 144 144=45361
24950:144 0   4   9   144=45662
24955:32  32  144 32  144=46046
24960:32  32  32  144 32  =46318
24965:32  144 0   5   9   =46508
24970:144 32  32  144 32  =46892
24975:144 144 144 32  144=47500
24980:32  32  144 0   6   =47714
24985:9   144 32  32  144=48075
24990:32  144 32  32  32  =48347
24995:144 32  32  144 0   =48699
25000:7   9   144 144 144=49147
25005:144 32  144 32  32  =49531
25010:32  144 144 144 144=50139
25015:2   0   13  6   1   =50161
25020:48  32  127 74  117=50559
25025:108 105 97  110 32  =51011
25030:87  111 111 100 32  =51452
25035:49  57  56  52  32  =51698
25040:0   21  1   1   143=51864
25045:32  32  32  32  80  =52072
25050:82  69  83  83  32  =52421
25055:39  83  80  65  67  =52755
25060:69  39  32  84  79  =53058
25065:32  80  76  65  89  =53400
25070:32  32  32  32  32  =53560
25075:2   0   21  0   1   =53584
25080:71  32  32  32  154=53905
25085:54  32  32  32  55  =54110
25090:153 32  32  32  151=54510
25095:56  32  32  32  57  =54719
25100:152 32  32  32  48  =55015
25105:61  72  65  76  84  =55373
25110:32  32  32  2   221=55692
25115:94  0   221 86  1   =56094
25120:123 178 200 221 110=56926
25125:2   221 102 3   1   =57255
25130:4   0   221 9   221=57710
25135:229 125 203 61  203=58531
25140:61  47  230 3   79  =58951
25145:6   0   221 33  209=59420
25150:3   221 9   58  72  =59783
25155:92  205 207 3   243=60533
25160:221 225 24  206 50  =61259
25165:0   0   6   50  0   =61315
25170:0   7   80  0   100=61502
25175:4   99  0   100 3   =61708
25180:100 0   210 3   0   =62021
25185:0   58  130 92  71  =62372
25190:33  11  91  205 63  =62775
25195:96  230 30  119 35  =63285
25200:54  1   35  16  244=63635
25205:201 1   254 239 237=64567
25210:120 31  56  8   237=65019
25215:120 47  230 30  40  =65486
25220:249 201 42  4   91  =66073
25225:68  77  31  56  1   =66306
25230:4   31  56  1   5   =66403
25235:31  56  1   12  31  =66534
25240:56  1   13  167 237=67008
25245:66  200 121 254 255=67904
25250:200 254 31  200 120=68709
25255:254 0   200 254 23  =69440
25260:40  83  205 46  96  =69910
25265:254 32  200 197 254=70847
25270:70  32  28  33  60  =71070
25275:0   17  1   0   205=71293
25280:180 95  45  32  247=71892
25285:1   1   0   205 98  =72197
25290:100 205 156 100 33  =72791
25295:176 92  203 198 203=73663
25300:142 33  250 0   17  =74105
25305:5   0   205 180 95  =74590
25310:237 75  4   91  205=75202
25315:1   97  175 50  143=75668
25320:92  62  32  205 199=76258
25325:96  193 237 67  4   =76855
25330:91  62  71  50  143=77272
25335:92  205 1   97  62  =77729
25340:145 205 199 96  201=78575
25345:33  176 92  203 78  =79157
25350:200 203 142 35  126=79863
25355:254 31  208 52  79  =80487
25360:6   23  205 1   97  =80819
25365:62  86  50  143 92  =81252
25370:62  150 205 199 96  =81964
25375:33  100 0   17  200=82314
25380:0   205 180 95  201=82995
25385:237 75  8   91  205=83611
25390:1   97  62  70  50  =83891
25395:143 92  58  129 92  =84405
25400:60  254 150 56  2   =84927
25405:62  146 50  129 92  =85406
25410:205 199 96  201 68  =86175
25415:77  205 46  96  254=86853
25420:32  200 254 69  200=87608
25425:254 8   201 58  10  =88139
25430:91  221 33  11  91  =88586
25435:71  4   237 91  4   =88993
25440:91  221 110 0   221=89636
25445:102 1   125 180 40  =90084
25450:94  5   197 229 123=90732
25455:189 40  10  56  2   =91029
25460:44  44  45  205 70  =91437
25465:99  32  32  225 122=91947
25470:188 40  51  229 56  =92521
25475:2   36  36  37  205=92837
25480:70  99  32  16  45  =93099
25485:205 70  99  32  10  =93515
25490:44  44  205 70  99  =93977
25495:32  3   225 24  34  =94295
25500:193 205 1   97  175=94966
25505:50  143 92  62  32  =95345
25510:205 199 96  68  77  =95990
25515:205 1   97  62  69  =96424
25520:50  143 92  62  150=96921
25525:205 199 96  221 117=97759
25530:0   221 116 1   237=98334
25535:91  4   91  167 237=98924
25540:82  204 208 99  193=99710
25545:221 35  221 35  16  =100236
25550:141 201 33  176 92  =100881
25555:203 70  202 181 100=101637
25560:66  75  205 1   97  =102081
25565:62  71  50  143 92  =102499
25570:62  145 205 199 96  =103206
25575:203 134 203 206 221=104173
25580:54  0   0   221 54  =104502
25585:1   0   33  50  0   =104586
25590:17  100 0   205 180=105088
25595:95  58  130 92  23  =105486
25600:33  10  91  134 79  =105833
25605:6   0   205 98  100=106242
25610:33  10  91  53  192=106621
25615:33  176 92  203 86  =107211
25620:200 203 150 193 193=108150
25625:193 193 195 50  101=108882
25630:58  177 92  95  29  =109333
25635:123 254 255 40  43  =110048
25640:62  86  50  143 92  =110481
25645:75  6   23  205 1   =110791
25650:97  62  32  205 199=111386
25655:96  58  130 92  23  =111785
25660:79  6   0   205 98  =112173
25665:100 213 62  32  147=112727
25670:23  111 38  0   17  =112916
25675:244 1   205 180 95  =113641
25680:209 24  207 193 33  =114307
25685:130 92  126 254 10  =114919
25690:32  1   175 60  119=115306
25695:195 1   101 42  2   =115647
25700:91  9   34  2   91  =115874
25705:1   3   0   205 1   =116084
25710:97  62  48  50  143=116484
25715:92  205 228 95  201=117305
25720:33  7   91  53  202=117691
25725:30  100 110 38  0   =117969
25730:1   19  0   205 1   =118195
25735:97  62  48  50  143=118595
25740:92  6   255 205 246=119399
25745:95  33  100 0   17  =119644
25750:5   0   205 180 95  =120129
25755:201 205 63  96  230=120924
25760:21  60  71  205 63  =121344
25765:96  230 30  79  205=121984
25770:46  96  254 32  40  =122452
25775:243 237 67  8   91  =123098
25780:201 193 193 193 193=124071
25785:33  0   0   17  1   =124122
25790:0   205 180 95  44  =124646
25795:32  247 33  6   91  =125055
25800:53  202 116 101 195=125722
25805:1   101 243 49  179=126295
25810:95  33  162 101 34  =126720
25815:123 92  33  0   60  =127028
25820:34  54  92  33  0   =127241
25825:0   34  0   91  205=127571
25830:23  97  33  0   0   =127724
25835:34  2   91  62  3   =127916
25840:50  6   91  62  1   =128126
25845:50  130 92  33  244=128675
25850:97  205 12  96  205=129290
25855:78  97  62  146 50  =129723
25860:129 92  62  99  50  =130155
25865:7   91  33  0   0   =130286
25870:34  176 92  205 77  =130870
25875:96  205 156 100 1   =131428
25880:0   22  237 67  4   =131758
25885:91  205 1   97  62  =132214
25890:71  50  143 92  62  =132632
25895:145 205 199 96  221=133498
25900:33  76  98  205 26  =133936
25905:98  62  1   50  10  =134157
25910:91  205 98  98  6   =134655
25915:3   197 6   2   197=135060
25920:1   1   20  11  120=135213
25925:177 32  251 205 118=135996
25930:98  193 16  241 205=136749
25935:84  99  205 41  99  =137277
25940:33  176 92  203 86  =137867
25945:32  17  33  10  91  =138050
25950:58  130 92  190 40  =138560
25955:3   52  24  5   33  =138677
25960:176 92  203 214 193=139555
25965:16  205 205 120 100=140201
25970:24  198 42  2   91  =140558
25975:237 75  0   91  167=141128
25980:237 66  56  18  9   =141514
25985:34  0   91  1   26  =141666
25990:0   205 1   97  62  =142031
25995:48  50  143 92  205=142569
26000:228 95  33  250 101=143276
26005:205 12  96  221 33  =143843
26010:13  102 205 26  98  =144287
26015:195 229 100 170 255=145236
26020:170 255 170 255 170=146256
26025:255 60  60  24  255=146910
26030:153 60  66  195 0   =147384
26035:0   0   24  24  0   =147432
26040:0   0   0   0   24  =147456
26045:60  60  24  0   0   =147600
26050:0   60  126 126 126=148038
26055:126 60  0   60  126=148410
26060:255 255 255 255 126=149556
26065:60  195 36  255 153=150255
26070:255 36  66  231 0   =150843
26075:16  56  84  16  16  =151031
26080:16  0   0   16  16  =151079
26085:16  84  56  16  0   =151251
26090:0   0   8   4   126=151389
26095:4   8   0   0   0   =151401
26100:16  32  126 32  16  =151623
26105:0   1   179 0   1   =151804
26110:9   32  60  71  65  =152041
26115:77  69  32  79  86  =152384
26120:69  82  62  32  2   =152631
26125:100 1   3   2   100=152837
26130:1   68  2   0   2   =152910
26135:178 2   100 2   68  =153260
26140:2   200 0   112 3   =153577
26145:0   1   12  3   0   =153593
26150:3   178 2   100 1   =153877
26155:68  2   0   3   12  =153962
26160:3   0   0   0   0   =153965
```

Listing 3.

```
  10>CLEAR 24499: LET c=0: FOR a
=24500 TO 26163 STEP 5
  20 PRINT a;":";: LET d=c: FOR
b=0 TO 4
  30 INPUT "Byte? ";n: IF n>255
THEN BEEP .5,20: GO TO 30
  40 IF n=-9 THEN LET c=d: LET a
=a-(5*NOT b): PRINT : GO TO 20
  50 LET c=c+n: POKE a+b,n: PRIN
T TAB b*4+6;n;: NEXT b: PRINT TA
B 26;c: NEXT a
```

Amstrad's new CPC464 comes with plenty of free plugs.



CPC464 green screen VDU (GT64)

ou may have noticed that the press got very excited about our new com- er system.

nd rightly so.

ecause the new CPC464 comes iplete with its own green screen J or colour monitor, built-in cassette recorder, 64K of RAM, 32K of M, typewriter style keyboard and a fast extended BASIC.

/hen you consider that the complete iputer system including green en VDU and cassette data recorder only set you back £249, that's plenty et excited about.

ou can use the green screen version ie CPC464 with a colour TV by connecting the optional power supply and modulator (MP-1).

> "I think the Amstrad will give a lot of sleepless nights to Sinclair, Acorn and Commodore..."
>
> POPULAR COMPUTING WEEKLY

Other micros can't get anywhere near the CPC464's memory for the price. Over 42K is available to users, thanks to the implementation of ROM overlay techniques.

Sophisticated and complex programs are easily accommodated.

And the CPC464 offers you high resolution graphics, 80 column text display, up to 8 text windows, a graphics window and a palette of 27 colours.

> "The CPC464... in two boxes and one lead includes a list of features that would shame a hybrid of the major machines."
>
> PERSONAL COMPUTER WORLD

One of the most obvious is the quality of the on-screen graphics. Quite simply, the CPC464 beats the micro/domestic TV combination out of sight.

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There's plenty of interest for music lovers when the 3-voice, 7-octave stereo output is fed through a hi-fi amplifier and speakers.

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>
> PERSONAL COMPUTER WORLD

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advantage of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.

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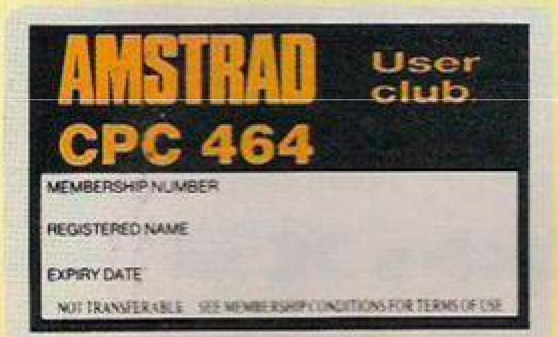

> "The Amstrad machine provides a lot of other features for a very low price."
>
> GUARDIAN

At Amstrad, we're constantly looking to the future. That's why the CPC464 has a built-in parallel printer interface. A low cost optional disk drive system including CP/M* (with the option to access 3000 programs) and LOGO. A joystick port. And the virtually unlimited potential of the Z80 data bus with sideways ROM support.

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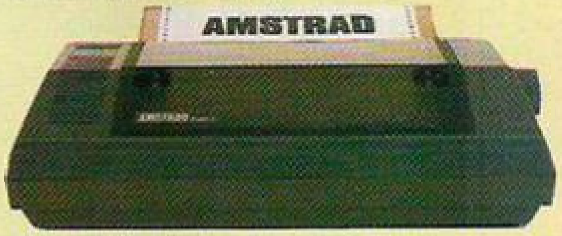

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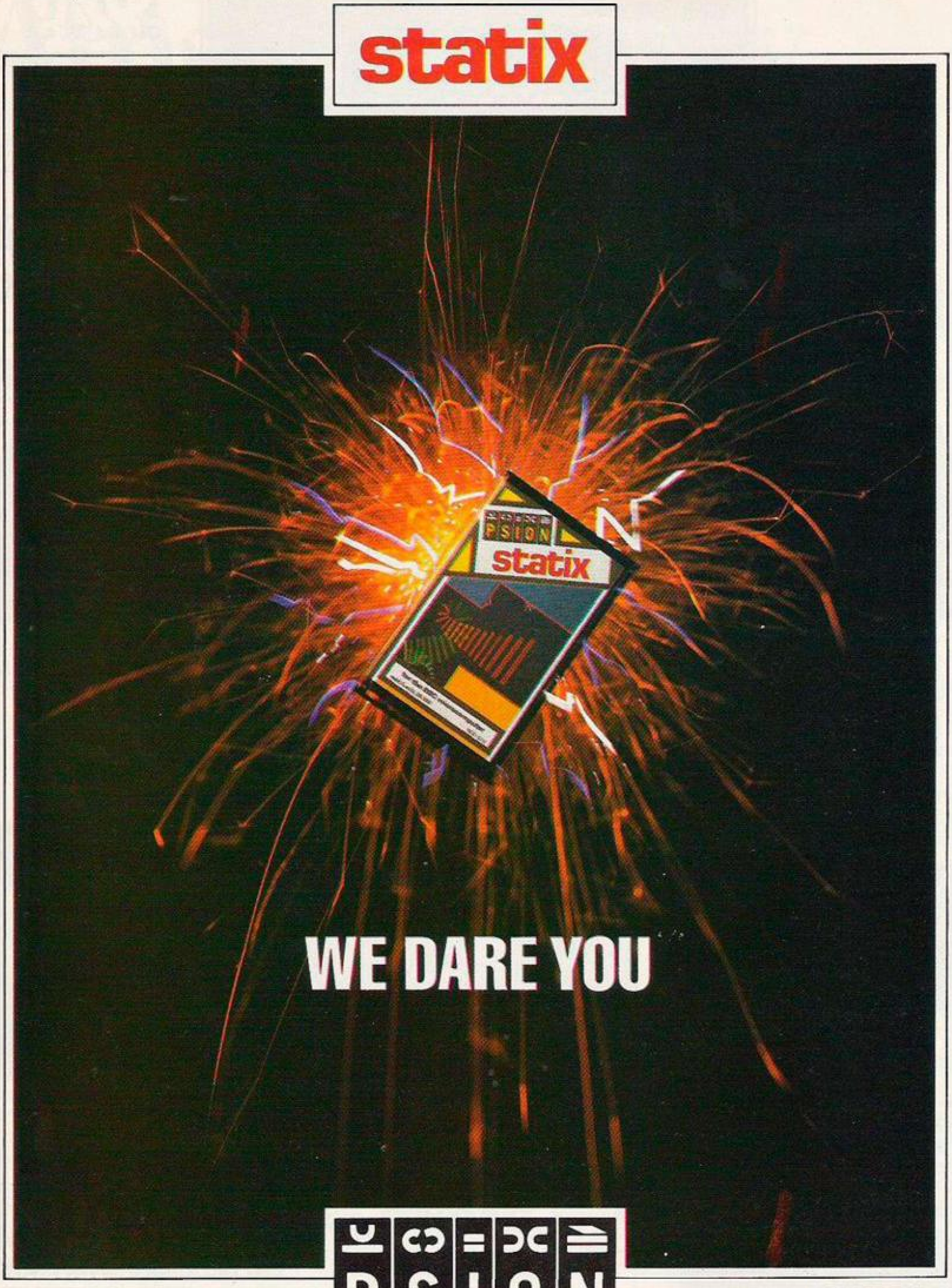

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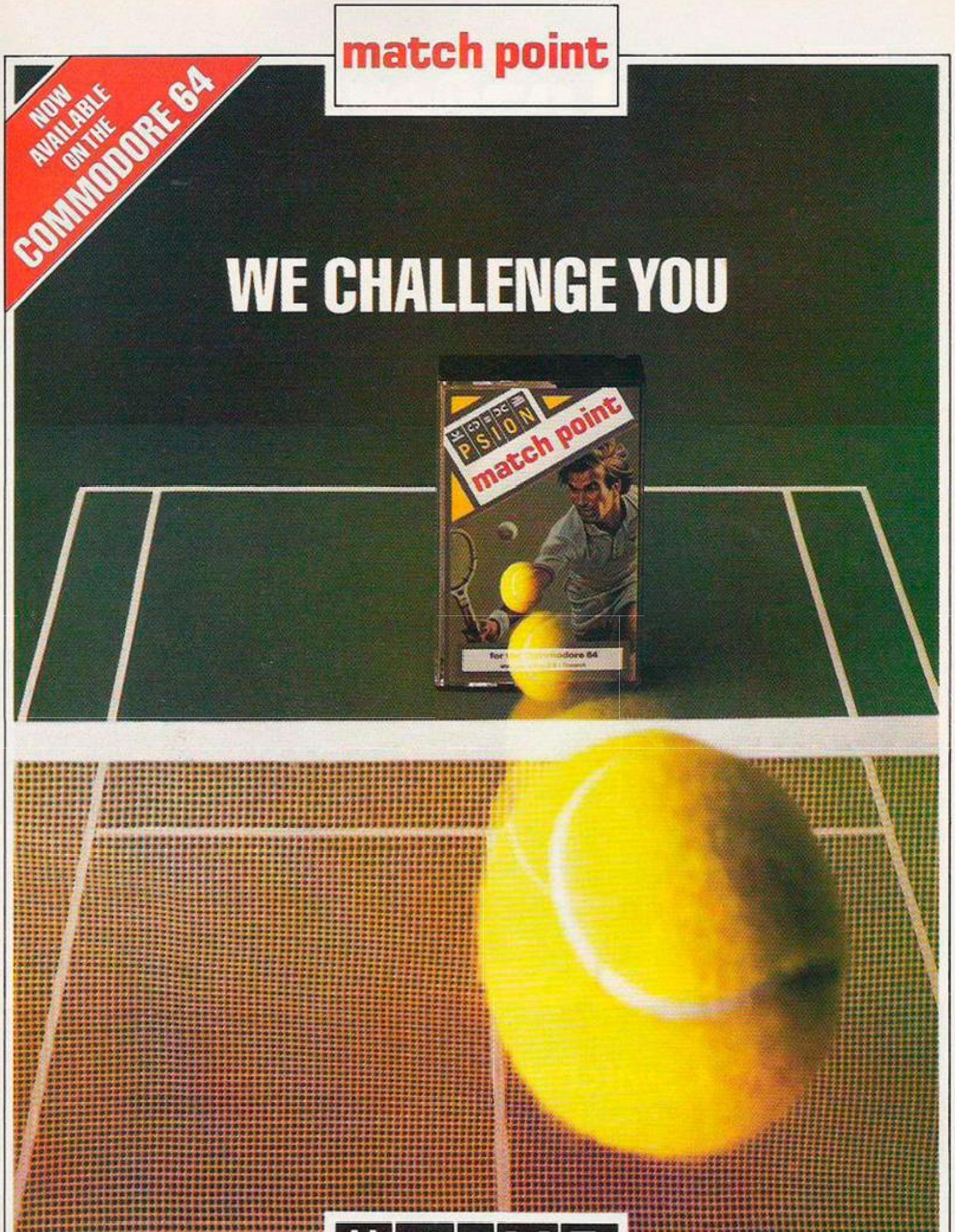
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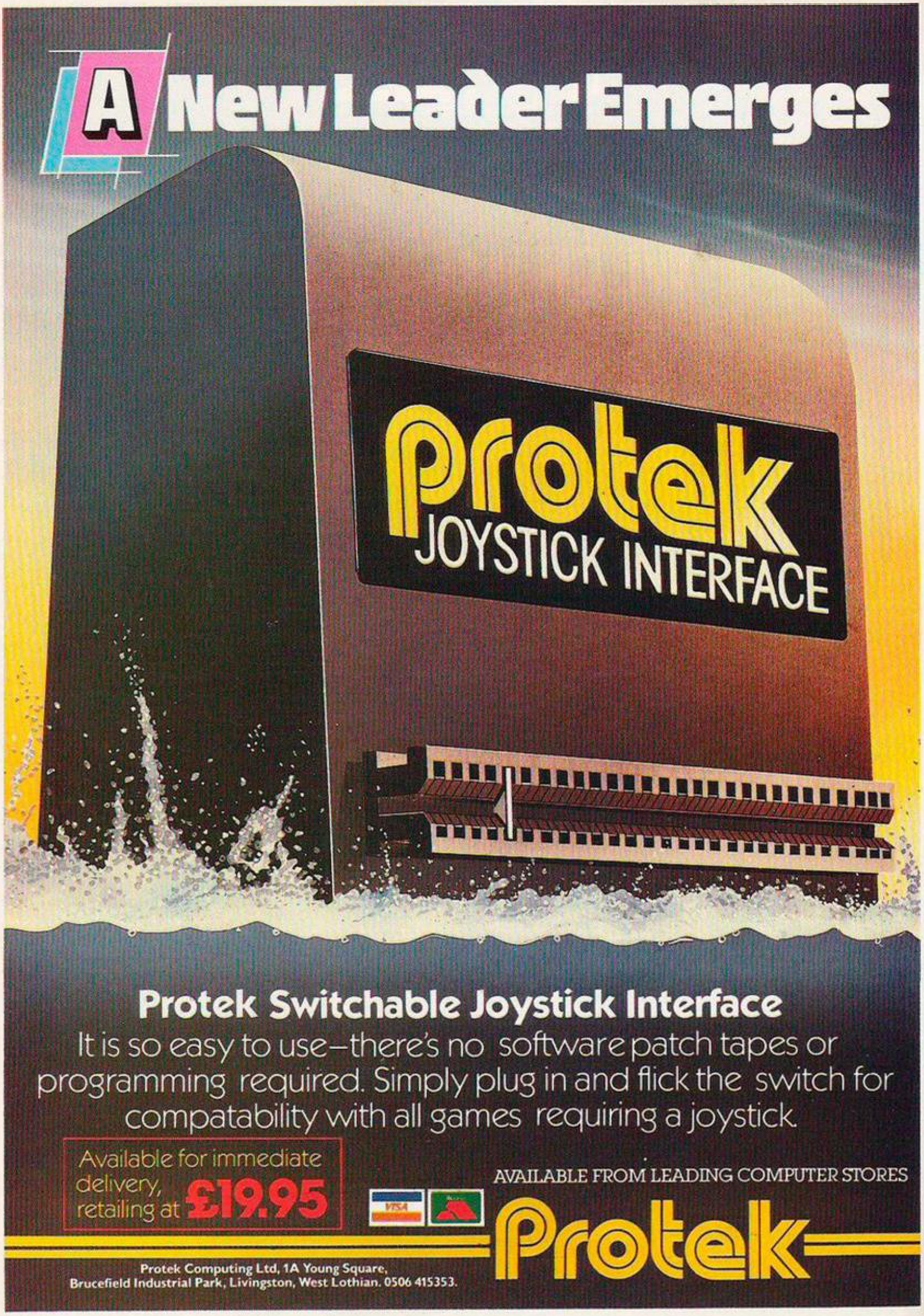
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AMSTRAD MUSIC

R Mitchell synthesises a synthesiser.

I WANTED A PROGRAM that would enable me to alter the Env and Ent variables easily and quickly and then be able to hear them. I also wanted to see what the envelopes looked like, without having to resort to Pen and Paper to draw it each time.

The program I ended up with is just over 14K long. You can even use the keys like a music keyboard and once the sounds have been defined you will have a music synthesiser.

I've used plenty of Rem statements throughout the program, so I won't go into detail and describe what each part does. It is possible to move quite freely about within it when running.

After typing in the program, Run it and you will be in screen 1. This is the title page and there are five pre-defined sound on it. You can define up to nine sounds, the first five are not permanent, so these can be altered quite easily but for now type in 1 and enter it.

When you press the Y key will first get a prompt to enter your title. After you enter this title you will be asked if you want Noise, Play or both enter one of these by pressing the N,P or B key. The next prompt is for repeat on the tone, enter Y or N. These prompts and title are purely for your own reference and in no way effect the program.

You should still be at the point in the program where the computer is waiting for you to answer it. Do you want to add a new title? Press N for no. You will now see a plotted graph — in white — of the volume envelope — screen 2. In the bottom left hand corner is the scale and the finished step. The scale can be altered by pressing D or M. The D will divide the scale by 2 and the M will multiply it by 2.

When you start working on your own volume or tone envelope and the plotted shape goes outside the graphic window then by pressing the D key you will see the graph re-plotted at half the original scale. The same applies when the plotted graph is too small by pressing the M it will be re-plotted at twice the original scale.

The finished step tells you where you are in relation to the 0 volume level. On the bottom right hand side is the tone and volume time. This tells you how long the note you are designing will last and how much of it will be affected by the tone.

If you typed in 1 earlier you should have displayed on the screen what I think a Piano waveform will look like. There are two horizontal lines, the bottom one — green — is the 0 volume level and the top one — red — is the 15 volume level — maximum. If you go above the top line you will get some unusual effects, also the section step total at the top of the screen will change from red to green.

At the top of the screen are the step count, step size and pause time, with a green arrow pointing to the first one. As you enter new values for this the arrow will move to the next one. The program will check to see if the values are correct each time you enter one, the arrow is controlled by using the cursor keys.

Press T and you will go to the tone envelope, this has one horizontal line and you can plot above or below it. Again in the bottom left hand corner is the finished step which tell you where you are in relation to the original frequency. Above this line increases the frequencies and below will decrease it. If you pressed 1 earlier then you will see a tone envelope for the Piano. Press E again and you will go back to the volume envelope.

If you Press C then all the values for the step count, step size and pause time will be re-set to 0. This only applies to whichever envelope is being displayed, so if you have the Piano waveform displayed on the volume

(continued on page 145)

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EPROM TYPE —27128
RAM START ADDR —4000
EPROM ST ADDR —0000
JOB LENGTH —4000
TASK —CHECK

WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
Y) BLOW AN EPROM WITH DATA FROM RAM
Z) VERIFY THAT EPROM DATA IS THE SAME AS IN RAM
Q TO QUIT R TO RESTART
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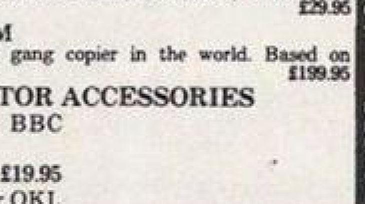

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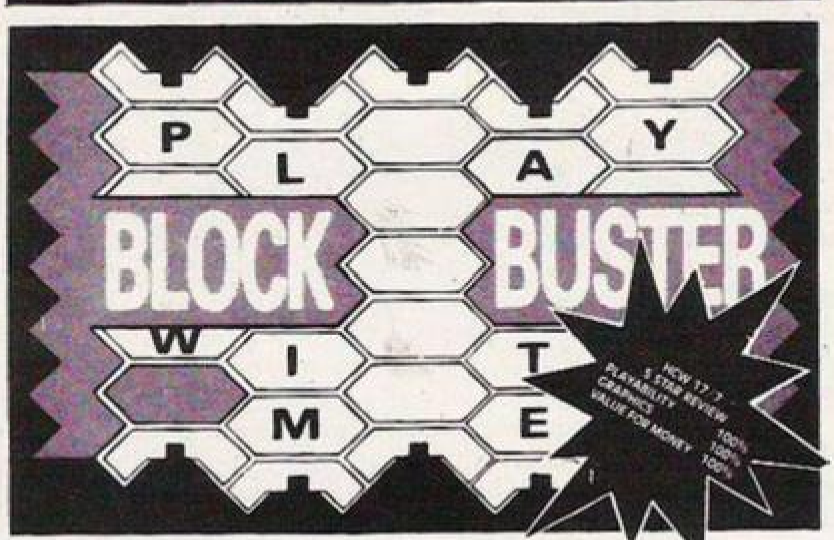

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Available for the Atari

Phone for software availability and comprehensive software lists

(continued from page 143)

envelope screen — screen 2 — and press C then this is the only one to be affected, it will not reset the tone envelope unless you are displaying it.

Commands for screen 2.
C — To clear the variables.
T — to display the tone envelope shape and input new values.
E — to display the volume envelope and input new values.
M — to multiply the plotted graph by two.
D — to divide the plotted graph by two.
R — to return to the title page — screen 1.
cursor keys to move the input arrow.
P — to play the note or noise — screen 3.

You are now ready to play a note so press the P key. This will take you to screen 3. This is the last screen and you will have displayed in front of you the instructions for playing a note or noise. But I will run through them briefly:

O — this tells the computer that you wish to use the noise and note the period.
P — this plays a sound using the period part of the sound command.
E — return to the volume envelope graph and input mode — screen 2.
T — return to then tone envelope and graph input mode — screen 2.
R — return to the title page — screen 1.
cursor keys up and down, to increase or decrease the octave or noise level.
+ — this will put the tone on repeat.
– — this will remove the repeat from the tone.
Q — this will automatically repeat the last note or noise played and keep on repeating it.
the left and right cursor keys will increase or decrease the speed at which the repeat occurs at.
W — this will cancel out the auto-repeat.
1 to 9 — By pressing these keys you are able to play another sound envelope, press 4 and you will get the Phaser envelopes to play, press 1 and you will get the Piano envelopes.

All the input commands are in the lower case, so don't use the Caps Lock or Shift keys.

On the left hand side just below the instruction on screen 3 you will see all the relevant information about the note or noise just played. Frequency, Period, Octave, Noise, Noise Range, Note Length — time, tone — vibrato — and name, as defined in the title page of the instrument or sound effect. So once you find the correct period or frequency of the note or sound effect that you are after, you only have to write it down. For example, Noise 6, and then press the T or E and write down the values you use in these two, step count, step size and pause time for each section and then you are ready to put them into your own program.

It is possible to use the keyboard to play a note across nine octaves, one octave at a time and you can play up to three notes at one time but only one noise. All the times that are displayed are in seconds.

I've used integer variables as much as possible to increase the speed and save some memory. If you want to make the tone envelope repeat in your own program don't forget to use a negative number when you define it e.g.:

ENT –2 or ENT –1 etc.

To alter the colours of the display:
COL% PAPER, COL2% PEN 1, COL3% PEN 2, COL4% PEN 3

If for any reason you break out of the program then type in Goto 520 and you won't lose any of the variables that you have already entered.

Finally, Enter the following values into the tone envelope for the Piano.

Step count	1	5
Step size	10	–2
Pause time	20	1

Use octave 2, 3 or 4. All I'll say is it comes from India. Put a Rem on line 90 On Error Goto until the program is free from typing errors. Delete line 150 when everything is O.K. If you press the small Enter key, it will reset the colours and key speed.

```
10 REM ***************************
20 REM *** MUSIC SYNTHESISER ***
30 REM ***        and          ***
40 REM ***   SOUND EFFECTS     ***
50 REM ***      PLOTTER        ***
60 REM ***  -----------------  ***
70 REM ***  by R. MITCHELL     ***
80 REM ***************************
90 ON ERROR GOTO 520
100 REM **********************
110 REM *** COL FOR INKS ***
120 REM **********************
130 col1%=0:col2%=23:col3%=21:col4%=7
140 INK 0,col1%:BORDER col1%:INK 1,col2%:PEN 1:PAPER 0
:SPEED KEY 20,1:CLS
150 KEY 139,"ink 0,1:border 1:ink 1,24:pen 1:paper 0:s
peed key 40,3"+CHR$(13)
160 SPEED KEY 255,255
170 BORDER col1%:INK 0,col1%:PAPER 0:INK 1,col2%:INK 2
,col3%:INK 3,col4%
180 DIM te(15,5,3):DIM ve(15,5,3)
190 DIM title$(9):DIM r$(9):DIM na$(9)
200 REM ********************
210 REM *** TITLE PAGE ***
220 REM ********************
230 title$(1)="PIANO-----------------":na$(1)="Play":r$(1)=
"No Repeat"
240 title$(2)="GUNSHOT---------------":na$(2)="Noise":r$(2)
="Repeat on"
250 title$(3)="SEA-------------------":na$(3)="Noise":r$(3)
="No Repeat"
260 title$(4)="PHASER----------------":na$(4)="Play":r$(4)=
"Repeat on"
270 title$(5)="SYBOLS----------------":na$(5)="Noise":r$(5)
="No Repeat"
280 FOR a%=6 TO 9
290 title$(a%)="................."
300 r$(a%)="..........":na$(a%)=".....":NEXT
310 WINDOW £1,1,40,4,23
320 sl=8:mul=1:oc=1:en%=1:wno%=1
330 REM ***************************
340 REM ***SET UP WAVE FORMS ***
350 REM ***************************
360 FOR number%=1 TO 5
370 FOR x%=1 TO 5:FOR y%=1 TO 3
380 READ a:ve(number%,x%,y%)=a:NEXT:NEXT
390 FOR x%=1 TO 5:FOR y%=1 TO 3
400 READ a:te(number%,x%,y%)=a:NEXT:NEXT
410 NEXT number%
420 DATA 1,15,1,3,-1,1,5,0,1,12,-1,5,0,0,0
430 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
440 DATA 5,3,1,13,-1,3,0,0,0,0,0,0,0,0,0
450 DATA 10,1,1,0,0,0,0,0,0,0,0,0,0,0,0
460 DATA 15,1,5,15,-1,5,0,0,0,0,0,0,0,0,0
470 DATA 5,3,3,3,-3,3,0,0,0,0,0,0,0,0,0
480 DATA 5,3,1,15,-1,5,0,0,0,0,0,0,0,0,0
490 DATA 80,10,1,0,0,0,0,0,0,0,0,0,0,0,0
500 DATA 3,5,1,13,-1,3,0,0,0,0,0,0,0,0,0
510 DATA 5,1,15,0,0,0,0,0,0,0,0,0,0,0,0
520 REM **************
530 REM *** TITLES ***
540 REM **************
550 CLS:PEN 1
560 FOR a%=2 TO 18 STEP 2
570 LOCATE 1,a%:PEN 3:PRINT a%/2;:PEN 1:PRINT" = ";tit
le$(a%/2)
580 LOCATE 25,a%:PRINT na$(a%/2)
590 LOCATE 31,a%:PRINT r$(a%/2):NEXT
600 LOCATE 10,25:INPUT"WAVEFORM No.";wno%
610 IF wno%<1 OR wno%>20 THEN 600
620 CLS:LOCATE 1,15:PRINT"Do You Wish To Add Another T
itle Y/N ?"
630 a$=INKEY$:IF a$="" THEN 630
640 IF a$="y"THEN 660
650 GOTO 860
660 LOCATE 1,15:PRINT SPACE$(40)
670 PEN 2:LOCATE 5,12:PRINT"ENTER A MAXIMUM OF 17 LETT
ERS"
680 PEN 1:LOCATE 11,5:PRINT"-----------------"
690 PEN 3:LOCATE 11,5:LINE INPUT title$(wno%)
700 title$(wno%)=title$(wno%)+"-----------------"
710 PEN 1
720 l%=LEN(title$(wno%))
730 IF l%>17 THEN title$(wno%)=LEFT$(title$(wno%),17)
740 title$(wno%)=UPPER$(title$(wno%))
750 LOCATE 5,16:PRINT"[N] Noise  [P] Play  [B].Both"
760 a$=INKEY$:IF a$=""THEN 760
770 IF a$="n"THEN na$(wno%)="Noise":GOTO 810
780 IF a$="p"THEN na$(wno%)="Play":GOTO 810
790 IF a$="b"THEN na$(wno%)="Both":GOTO 810
800 GOTO 760
810 LOCATE 15,20:PRINT"REPEAT Y/N"
820 a$=INKEY$:IF a$=""THEN 820
830 IF a$="y"THEN r$(wno%)="Repeat on":GOTO 850
840 IF a$="n"THEN r$(wno%)="No Repeat":GOTO 850
850 GOTO 550
860 REM ****************************
870 REM *** Print Top of Screen ***
880 REM ****************************
890 CLS:PEN 3
900 LOCATE 1,1
910 IF en%=1 THEN PRINT"Volume env sec";
920 IF en%=2 THEN PRINT"Tone env sec";
930 PEN 1
940 LOCATE 1,2:PRINT"Step count";
950 LOCATE 1,3:PRINT"Step Size";
960 LOCATE 1,4:PRINT"Pause Time";
970 PEN 3
980 LOCATE 1,5:PRINT"Time in Secs.";
990 PEN 3
1000 FOR a%=1 TO 5
1010 LOCATE a%*5+11,1:PRINT a%;:NEXT
1020 LOCATE 25,24:PRINT"Vol. time=";
1030 LOCATE 25,25:PRINT"tone time=";
1040 LOCATE 1,24:PEN 2
1050 PRINT"Scale=";
1060 LOCATE 1,25:PRINT"Finished step=";
1070 PEN 1
1080 GOSUB 2000:GOSUB 2190:GOSUB 1590
1090 REM ********************
1100 REM *** Print Cursor ***
1110 REM ********************
1120 REM *** Move Cursor ****
1130 REM *** Input Values ***
1140 REM ********************
1150 x%=1:y%=1:xx%=x%:yy%=y%
1160 b$=""
1170 PEN 2:LOCATE xx%*5+10,yy%+1:PRINT" ";
1180 PRINT CHR$(7)
1190 LOCATE x%*5+10,y%+1:PRINT CHR$(243);
1200 xx%=x%:yy%=y%
1210 a$=INKEY$:IF a$=""THEN 1210
1220 IF a$="r"THEN 520
1230 IF a$="m"THEN sl=sl*2:GOSUB 1590
1240 IF a$="d"THEN sl=sl/2:GOSUB 1590
1250 IF a$="p"THEN 2460
1260 IF a$="t"THEN en%=2:GOTO 860
1270 IF a$="e"THEN en%=1:GOTO 860
1280 IF a$="c"THEN 1440
1290 IF a$=CHR$(13)THEN 1480
1300 IF a$=CHR$(240)THEN y%=y%-1
1310 IF a$=CHR$(241)THEN y%=y%+1
1320 IF a$=CHR$(242)THEN x%=x%-1
1330 IF a$=CHR$(243)THEN x%=x%+1
1340 IF x%<1 THEN x%=1
1350 IF x%>5 THEN x%=5
1360 IF y%<1 THEN y%=1
1370 IF y%>3 THEN y%=3
1380 IF a$="o"THEN 1410
1390 IF a$="-"THEN 1410
1400 v1%=VAL(a$):IF v1%<1 OR v1%>9 THEN 1170
1410 b$=b$+a$
1420 LOCATE x%*5+12,y%+1:PRINT b$;
1430 GOTO 1170
1440 FOR c11%=1 TO 5:FOR c12%=1 TO 3
1450 IF en%=1 THEN ve(wno%,c11%,c12%)=0
1460 IF en%=2 THEN te(wno%,c11%,c12%)=0
1470 NEXT:NEXT:GOTO 1510
1480 IF en%=1 THEN ve(wno%,x%,y%)=VAL(b$)
1490 IF en%=2 THEN te(wno%,x%,y%)=VAL(b$)
1500 GOTO 2240
1510 GOSUB 1590
1520 x%=xx%:y%=yy%
1530 y%=y%+1:IF y%>3 THEN y%=1:x%=x%+1
1540 IF x%>5 THEN x%=5:y%=3
1550 GOTO 1160
1560 REM **********************************
1570 REM ** Print out Env/Ent Values **
1580 REM **********************************
1590 PEN 1:CLS £1
1600 IF sl<0.0625 THEN sl=0.0625
1610 FOR y1%=1 TO 3:FOR x1%=1 TO 5
1620 LOCATE x1%*5+11,y1%+1
1630 IF en%=1 THEN PRINT ve(wno%,x1%,y1%);" "
1640 IF en%=2 THEN PRINT te(wno%,x1%,y1%);" "
1650 NEXT:NEXT
1660 PEN 3:FOR x1%=1 TO 5
1670 LOCATE x1%*5+11,y1%+1
1680 IF en%=1 THEN PRINT ve(wno%,x1%,1)*ve(wno%,x1%,3)
/100;" ";
1690 IF en%=2 THEN PRINT te(wno%,x1%,1)*te(wno%,x1%,3)
/100;" ";
1700 NEXT
1710 IF en%=1 THEN GOSUB 1790
1720 IF en%=2 THEN GOSUB 2080
1730 LOCATE 35,24:PRINT USING "££.££"; voltime/100;
1740 LOCATE 35,25:PRINT USING "££.££"; totime/100;

1750 LOCATE 7,24:PEN 2
1760 PRINT;sl;" ";
1770 LOCATE 15,25:PRINT totstp;" ";
1780 RETURN
1790 REM ************************
1800 REM *** Volume Envelope ***
1810 REM ************************
1820 PEN 1
1830 LOCATE 18,23:PRINT"Time ";:PRINT CHR$(243)
1840 PEN 3
1850 LOCATE 1,6:PRINT"Section Step";
1860 FOR sec%=1 TO 5
1870 secstep=ve(wno%,sec%,1)*ve(wno%,sec%,2)
1880 IF secstep>15 THEN PEN 2
1890 LOCATE sec%*5+11,6:PRINT secstep;
1900 NEXT
1910 ORIGIN 0,32+15*sl:DRAWR 640,0,3
1920 ORIGIN 0,32,0,640,300,48
1930 FOR tot%=1 TO 5
1940 acc=ve(wno%,tot%,1)
1950 FOR a%=1 TO acc
1960 DRAWR ve(wno%,tot%,3)*sl,0,1
1970 DRAWR 0,ve(wno%,tot%,2)*sl,1
1980 NEXT:NEXT
1990 ORIGIN 0,32:DRAWR 640,0,2
2000 totstp=0:voltime=0:FOR a%=1 TO 5
2010 t1=ve(wno%,a%,1):t2=ve(wno%,a%,2):t3=ve(wno%,a%,3
)
2020 totstp=totstp+(t1*t2)
2030 voltime=voltime+(t1*t3):NEXT
2040 RETURN
2050 REM **********************
2060 REM *** Tone Envelope ***
2070 REM **********************
2080 PEN 3
2090 ORIGIN 0,176:DRAWR 640,0,2
2100 ORIGIN 0,176,0,640,288,66
2110 FOR tot%=1 TO 5
2120 acc=te(wno%,tot%,1)
2130 FOR a%=1 TO acc
2140 DRAWR te(wno%,tot%,3)*sl,0,1
2150 DRAWR 0,-te(wno%,tot%,2)*sl,1
2160 NEXT:NEXT
2170 LOCATE 12,22:PRINT"Decrease Frequency";
2180 LOCATE 12,7:PRINT"Increase Frequency";
2190 totstp=0:totime=0:FOR a%=1 TO 5
2200 t1=te(wno%,a%,1):t2=te(wno%,a%,2):t3=te(wno%,a%,3
)
2210 totstp=totstp+(t1*t2)
2220 totime=totime+(t1*t3):NEXT
2230 RETURN
2240 REM ******************************
2250 REM * Check For Correct Values *
2260 REM ******************************
2270 IF en%=1 THEN 2370
2280 FOR x=1 TO 5
2290 IF te(wno%,x,1)>239 THEN te(wno%,x,1)=239
2300 IF te(wno%,x,1)<0 THEN te(wno%,x,1)=0
2310 IF te(wno%,x,2)>127 THEN te(wno%,x,2)=127
2320 IF te(wno%,x,2)<-128 THEN te(wno%,x,2)=-128
2330 IF te(wno%,x,3)>255 THEN te(wno%,x,3)=255
2340 IF te(wno%,x,3)<0 THEN te(wno%,x,3)=0
2350 NEXT x
2360 GOTO 1510
2370 FOR x=1 TO 5
2380 IF ve(wno%,x,1)>127 THEN ve(wno%,x,1)=127
2390 IF ve(wno%,x,1)<0 THEN ve(wno%,x,1)=0
2400 IF ve(wno%,x,2)>127 THEN ve(wno%,x,2)=127
2410 IF ve(wno%,x,2)<-128 THEN ve(wno%,x,2)=-128
```

(listing continued on next page)

(listing continued from previous page)

```
2420 IF ve(wno%,x,3)>255 THEN ve(wno%,x,3)=255
2430 IF ve(wno%,x,3)<0 THEN ve(wno%,x,3)=0
2440 NEXT x
2450 GOTO 1510
2460 CLS
2470 REM ******************************
2480 REM *** PRINT OUT INSTRUCTIONS ***
2490 REM ******************************
2500 CLS:PEN 2:PRINT "PRESS ";:PEN 1:PRINT"[O]";:PEN 2
:PRINT" FOR NOISE USE KEYS Z X C V B N";
2510 PRINT"KEYS ";:PEN 1:PRINT"1 to 9";:PEN 2:PRINT" F
OR ENVELOPE and TONE NUMBER";
2520 PRINT"  PRESS ";:PEN 1:PRINT"[R]";:PEN 2:PRINT"=R
ETURN ";:PEN 1:PRINT"[E]";:PEN 2:PRINT"=VOLUME ";:PEN
1:PRINT"[T]";:PEN 2:PRIN
T"=TONE";
2530 PEN 1:PRINT" [+]";:PEN 2:PRINT" To ADD REPEAT ";:
PEN 1:PRINT"[-]";:PEN 2:PRINT" TO REMOVE REPEAT";
2540 PRINT" USE ";:PEN 1:PRINT CHR$(240);:PEN 2:PRINT"
 and ";:PEN 1:PRINT CHR$(241);:PEN 2:PRINT" TO INC. AN
D DEC. FREQUENCY";
2550 PEN 1:PRINT:PRINT:PRINT"[Q]";:PEN 2:PRINT" TO REP
EAT SOUND ";:PEN 1:PRINT"[W]";:PEN 2:PRINT" TO CANCEL
REPEAT";
2560 PRINT"  USE ";:PEN 1:PRINT CHR$(242);:PEN 2:PRINT
" TO INCREASE AND ";:PEN 1:PRINT CHR$(243);:PEN 2:PRIN
T" TO DECREASE"
2570 PRINT"              SPEED OF REPEAT"
2580 LOCATE 11,11:PRINT"PRESS ";:PEN 1:PRINT"[P]";:PEN
 2:PRINT" FOR NOTES"
2590 LOCATE 17,13:PRINT"Z = C":LOCATE 17,14:PRINT"S =
C£"
2600 LOCATE 17,15:PRINT"X = D":LOCATE 17,16:PRINT"D =
D£"
2610 LOCATE 17,17:PRINT"C = E":LOCATE 17,18:PRINT"V =
F"
2620 LOCATE 17,19:PRINT"G = F£":LOCATE 17,20:PRINT"B =
 G"
2630 LOCATE 17,21:PRINT"H = G£":LOCATE 17,22:PRINT"N =
 A"
2640 LOCATE 17,23:PRINT"J = A£":LOCATE 17,24:PRINT"M =
 B"
2650 LOCATE 29,23:PRINT"TONE"
2660 GOSUB 3710:rpt=1:LOCATE 27,25:PRINT"No Repeat"
2670 GOSUB 3490
2680 b1=7902.133:a2=7458.621:a1=7040:g2=6644.875:g1=62
71.927:f2=5919.911
2690 f1=5587.652:e1=5274.041:d2=4978.032:d1=4698.636:c
2=4434.922:c1=4186.009
2700 n1%=1:n2%=2:n3%=3:n4%=4:n5%=5:n6%=6
2710 GOTO 2720
2720 GOSUB 3820
2730 IF sond=1 THEN LOCATE 1,23:PRINT"OCTAVE";9-oc-4;
2740 IF sond=2 THEN LOCATE 1,23:PRINT"Noise=";nos;" ";
2750 GOSUB 3430
2760 REM ******************
2770 REM *** KEY INPUT ***
2780 REM ******************
2790 a$=INKEY$:IF a$="" THEN 2790
2800 IF sond%=1 AND a$=CHR$(241)THEN mul=mul*2:oc=oc-1
2810 IF sond%=2 AND a$=CHR$(241)THEN m1%=m1%-5
2820 IF sond%=1 AND a$=CHR$(240)THEN mul=mul/2:oc=oc-1
2830 IF sond%=2 AND a$=CHR$(240)THEN m1%=m1%+5
2840 IF mul<0.5 THEN PRINT CHR$(7);mul=0.5:oc=1
2850 IF mul>128 THEN PRINT CHR$(7);mul=128:oc=9
2860 IF m1%<0 THEN PRINT CHR$(7):m1%=0
2870 IF m1%>25 THEN PRINT CHR$(7):m1%=25
2880 IF sond%=1 AND a$="m"THEN freq=b1/mul:GOTO 3270
2890 IF sond%=1 AND a$="j"THEN freq=a2/mul:GOTO 3270
2900 IF sond%=1 AND a$="n"THEN freq=a1/mul:GOTO 3270
2910 IF sond%=2 AND a$="n"THEN nos=n6%+m1%:GOTO 3320
2920 IF sond%=1 AND a$="h"THEN freq=g2/mul:GOTO 3270
2930 IF sond%=1 AND a$="b"THEN freq=g1/mul:GOTO 3270
2940 IF sond%=2 AND a$="b"THEN nos=n5%+m1%:GOTO 3320
2950 IF sond%=1 AND a$="g"THEN freq=f2/mul:GOTO 3270
2960 IF sond%=1 AND a$="v"THEN freq=f1/mul:GOTO 3270
2970 IF sond%=2 AND a$="v"THEN nos=n4%+m1%:GOTO 3320
2980 IF sond%=1 AND a$="c"THEN freq=e1/mul:GOTO 3270
2990 IF sond%=2 AND a$="c"THEN nos=n3%+m1%:GOTO 3320
3000 IF sond%=1 AND a$="d"THEN freq=d2/mul:GOTO 3270
3010 IF sond%=1 AND a$="x"THEN freq=d1/mul:GOTO 3270
3020 IF sond%=2 AND a$="x"THEN nos=n2%+m1%:GOTO 3320
3030 IF sond%=1 AND a$="s"THEN freq=c2/mul:GOTO 3270
3040 IF sond%=1 AND a$="z"THEN freq=c1/mul:GOTO 3270
3050 IF sond%=2 AND a$="z"THEN nos=n1%+m1%:GOTO 3320
3060 IF a$="o"THEN sond%=2:LOCATE 1,17:PRINT"
     ":LOCATE 1,19:PRINT"                    ":GOSUB 3370:
GOTO 2750
3070 IF a$="p"THEN sond%=1:LOCATE 1,17:PRINT"
     ":GOSUB 3370:GOTO 2750
3080 IF a$="e"THEN en%=1:GOTO 860
3090 IF a$="t"THEN en%=2:GOTO 860
3100 IF a$="r"THEN 520
3110 IF a$="q"THEN rpt=-1:LOCATE 27,25:PRINT"Repeat on
":GOSUB 3490
3120 IF a$="q"THEN GOSUB 3990
3130 IF a$="-"THEN rpt=1:LOCATE 27,25:PRINT"No Repeat"
:GOSUB 3490
3140 IF a$="1"THEN wno%=1:GOSUB 3490
3150 IF a$="2"THEN wno%=2:GOSUB 3490
3160 IF a$="3"THEN wno%=3:GOSUB 3490
3170 IF a$="4"THEN wno%=4:GOSUB 3490
3180 IF a$="5"THEN wno%=5:GOSUB 3490
3190 IF a$="6"THEN wno%=6:GOSUB 3490
3200 IF a$="7"THEN wno%=7:GOSUB 3490
3210 IF a$="8"THEN wno%=8:GOSUB 3490
3220 IF a$="9"THEN wno%=9:GOSUB 3490
3230 GOTO 2730
3240 REM ********************************
3250 REM *** DECIDE WHICH CHANNEL ***
3260 REM ********************************
3270 tone=ROUND(125000/freq)
3280 IF sond%=1 THEN SOUND enno%,tone,voltime,0,1,1
3290 IF enno%=1 THEN enno%=2:GOSUB 3370:GOTO 2750
3300 IF enno%=2 THEN enno%=4:GOSUB 3370:GOTO 2750
3310 IF enno%=4 THEN enno%=1:GOSUB 3370:GOTO 2750
3320 IF sond%=2 THEN  SOUND 1,0,voltime,0,1,1,nos
3330 GOSUB 3370:GOTO 2750
3340 REM ********************************
3350 REM *** PRINT FREQ. NOISE ETC. ***
3360 REM ********************************
3370 IF freq>15804.266 THEN freq=15804.266
3380 IF freq<32.703 THEN freq=32.703
3390 IF sond%=1 THEN LOCATE 1,17:PRINT"PERIOD =";ROUND
(125000/freq);:PRINT"  ";
3400 IF sond%=2 THEN LOCATE 1,23:PRINT"Noise=";nos;" "
;
3410 IF sond%=1 THEN LOCATE 1,19:PRINT"FREQ=";:PRINT U
SING"££££.££";freq
3420 IF sond%=2 THEN  LOCATE 1,19:PRINT"              "
3430 IF sond%=2 THEN LOCATE 1,17:PRINT "RANGE=";n1%+m1
%;"to";n6%+m1%
3440 IF sond%=1 THEN LOCATE 1,23:PRINT"OCTAVE";9-oc-3
3450 RETURN
3460 REM ****************************
3470 REM *** DECIDE WHICH TONE ***
3480 REM ****************************
3490 IF en%=1 THEN GOSUB 2000
3500 IF en%=2 THEN GOSUB 2190
3510 FOR x%=1 TO 5:tt%=0:FOR y%=1 TO 3
3520 ty%=te(wno%,x%,y%):tt%=tt%+ty%:NEXT
3530 IF tt%=0 THEN x%=x%-1:GOTO 3550
3540 NEXT x%:x%=x%-1
3550 IF x%=0 THEN 3660
3560 ON x% GOTO 3570,3590,3610,3630,3650
3570 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3)
3580 GOTO 3670
3590 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3),te
(wno%,2,1),te(wno%,2,2),te(wno%,2,3)
3600 GOTO 3670
3610 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3),te
(wno%,2,1),te(wno%,2,2),te(wno%,2,3),te(wno%,3,1),te(w
no%,3,2),te(wno%,3,3)
3620 GOTO 3670
3630 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3),te
(wno%,2,1),te(wno%,2,2),te(wno%,2,3),te(wno%,3,1),te(w
no%,3,2),te(wno%,3,3),te
(wno%,4,1),te(wno%,4,2),te(wno%,4,3)
3640 GOTO 3670
3650 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3),te
(wno%,2,1),te(wno%,2,2),te(wno%,2,3),te(wno%,3,1),te(w
no%,3,2),te(wno%,3,3),te
(wno%,4,1),te(wno%,4,2),te(wno%,4,3),te(wno%,5,1),te(w
no%,5,2),te(wno%,5,3)
3660 ENT rpt,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
3670 ENV 1,ve(wno%,1,1),ve(wno%,1,2),ve(wno%,1,3),ve(w
no%,2,1),ve(wno%,2,2),ve(wno%,2,3),ve(wno%,3,1),ve(wno
%,3,2),ve(wno%,3,3),ve(w
no%,4,1),ve(wno%,4,2),ve(wno%,4,3),ve(wno%,5,1),ve(wno
%,5,2),ve(wno%,5,3)
3680 REM ********************
3690 REM *** PRINT TITLE ***
3700 REM ********************
3710 l%=LEN(title$(wno%)):IF l%>11 THEN l%=11
3720 FOR i1%=1 TO l%
3730 s$=MID$(title$(wno%),i1%,1)
3740 IF s$=CHR$(45)THEN 3760
3750 NEXT
3760 t$=LEFT$(title$(wno%),i1%-1)
3770 LOCATE 1,15:PRINT"              "
3780 LOCATE 1,13:PRINT"              "
3790 PEN 1
3800 LOCATE 1,13:PRINT t$
3810 PEN 2:LOCATE 1,15:PRINT"Note Len";voltime/100:PEN
 1
3820 REM **********************
3830 REM *** Find high/low ***
3840 REM **********************
3850 tot%=0:lo%=0:hi%=0
3860 FOR freq%=1 TO 5
3870 check%=te(wno%,freq%,1)*te(wno%,freq%,2)
3880 tot%=tot%+check%
3890 IF hi%>tot% THEN hi%=tot%
3900 IF lo%<tot% THEN lo%=tot%
3910 NEXT freq%
3920 PEN 2:LOCATE 1,21:PRINT"plus";ABS(hi%);" ";
3930 LOCATE 1,25:PRINT"minus";lo%;" ";
3940 PEN 1
3950 RETURN
3960 REM ********************
3970 REM *** REPEAT NOTE ***
3980 REM ********************
3990 LOCATE 24,16:PEN 1:PRINT"SPEED OF REPEAT"
4000 rptime=voltime
4010 ttim=INT(TIME/3)
4020 ctim=ttim+rptime
4030 ttim=INT(TIME/3)
4040 LOCATE 28,18:PEN 1:PRINT rptime/100
4050 a$=INKEY$
4060 IF ttim>=ctim THEN 4110
4070 IF a$="w"THEN LOCATE 24,16:PRINT"
:LOCATE 28,18:PRINT"      ":RETURN
4080 IF a$=CHR$(242)THEN rptime=rptime-1
4090 IF a$=CHR$(243)THEN rptime=rptime+1
4100 GOTO 4030
4110 IF sond%=1 THEN SOUND 1,tone,rptime,0,1,1
4120 IF sond%=2 THEN SOUND 1,0,rptime,0,1,1,nos
4130 GOTO 4010
```


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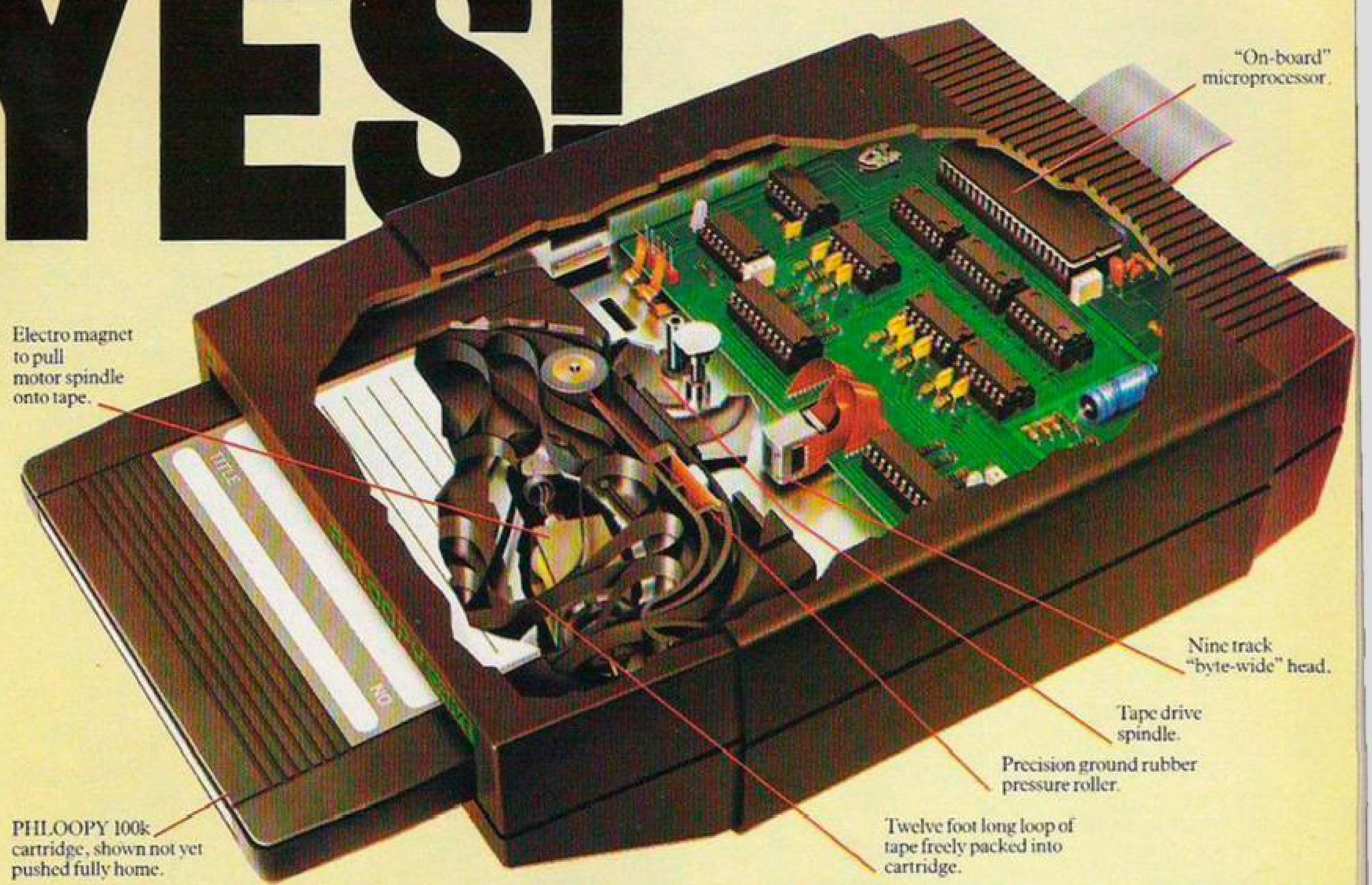

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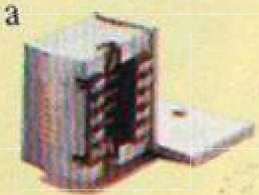

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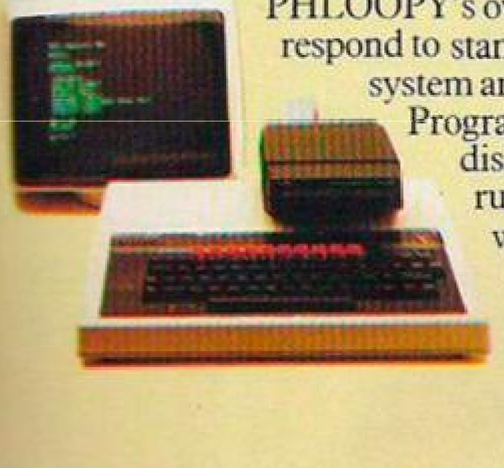

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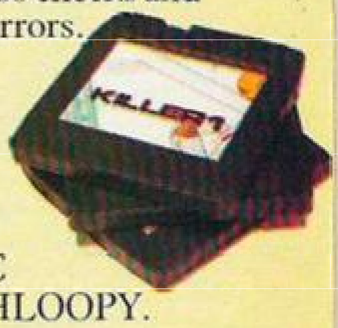

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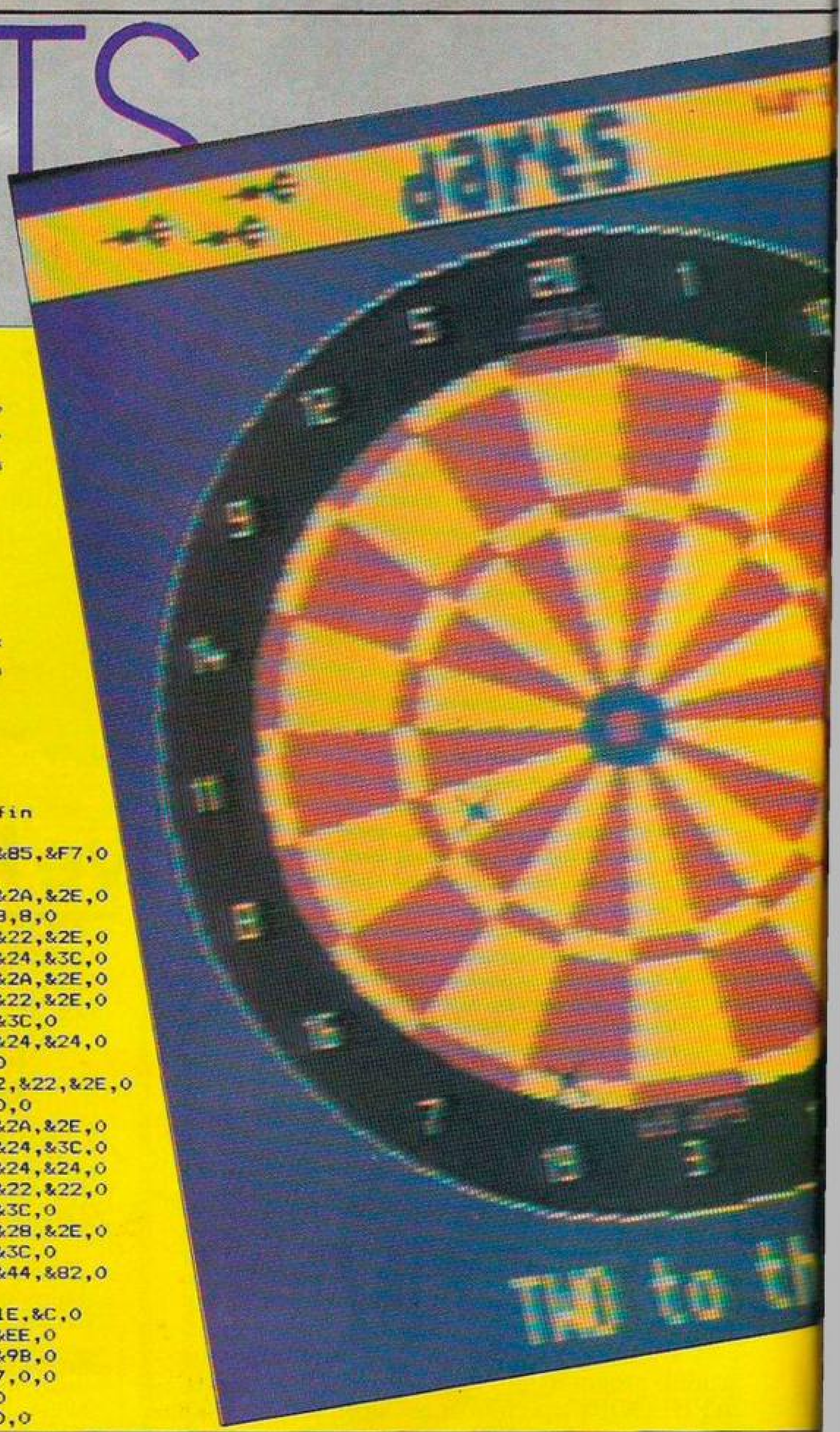
DARTS

Fag in mouth and beer in hand, David Griffin goes for the bull's eye.



Listing 1.

```
    1 REM Listing 1
    2 REM BBC Darts   -   by David Griffin
    3
   10 MODE 7
   20 PRINT TAB(9,4)""""CHR$255"`m0 &+t"""CHR$255"`k47
k7oh7`m"
   30 PRINT TAB(10,5)CHR$255" )5j::"CHR$255" "CHR$255"
.v' j5 ""-,t"
   40 PRINT TAB(9,6)"_"CHR$255"p>'z0_"CHR$255"p"CHR$25
5"O*u zu *tp?"
   50 PRINT TAB(8,8)"written by David Griffin"
   60 PRINT TAB(23,9)"(c) 1984"
   70 PRINT TAB(17,10)"x"CHR$255"`8"
   80 PRINT TAB(16)"h"CHR$255"a&x5"
   90 PRINT TAB(16)"j)y^?!"
  100 PRINT TAB(14)" x?``!"
  110 PRINT TAB(12)"_x"CHR$255"7"
  120 PRINT TAB(11)"h"CHR$255CHR$255"7"
  130 PRINT TAB(10)" "CHR$255"?`"
  140 PRINT TAB(9)"_&!"
  150 PRINT TAB(8)"8!"
  160 FOR Y=3 TO 20:VDU 31,5,Y,132,157,31,35,Y,156:NEX
T
  170 VDU 31,7,4,147,154,31,7,5,147,154,31,7,6,147,154
,31,7,8,135,31,7,9,135
  180 FOR Y=10 TO 18:VDU 31,7,Y,145:NEXT
  190 FOR Y=15 TO 18:VDU 31,15,Y,130:NEXT
  200 VDU 28,16,18,34,16
  210 *L."darts"900
  220 PAGE=&D00:CHAIN"darts....."
```

Listing 2.

```
  1 REM Listing 2
  2 REM BBC Darts   -   by David Griffin
  3
 10 VDU 23,128,&F7,&15,&15,&F5,&85,&85,&F7,0
 20 VDU 23,129,8,&18,8,8,8,8,8,0
 30 VDU 23,130,&2E,&6A,&2A,&2E,&2A,&2A,&2E,0
 40 VDU 23,131,&20,&20,&20,&28,&3C,8,8,0
 50 VDU 23,132,&2E,&62,&22,&2E,&22,&22,&2E,0
 60 VDU 23,133,&3C,&20,&20,&3C,&24,&24,&3C,0
 70 VDU 23,134,&2E,&6A,&2A,&2A,&2A,&2A,&2E,0
 80 VDU 23,135,&2E,&68,&28,&2E,&22,&22,&2E,0
 90 VDU 23,136,&3C,4,4,&3C,&20,&20,&3C,0
100 VDU 23,137,&2E,&62,&22,&22,&24,&24,&24,0
110 VDU 23,138,&38,8,8,&38,8,8,&38,0
120 VDU 23,139,0,&2E,&6A,&2A,&2E,&22,&22,&2E,0
130 VDU 23,140,&3C,4,8,8,&10,&10,&10,0
140 VDU 23,141,&2E,&68,&28,&2E,&2A,&2A,&2E,0
150 VDU 23,142,&3C,&24,&24,&3C,&24,&24,&3C,0
160 VDU 23,143,&24,&6C,&24,&24,&24,&24,&24,0
170 VDU 23,144,&28,&68,&28,&2A,&2F,&22,&22,0
180 VDU 23,145,&3C,&24,&24,&3C,4,4,&3C,0
190 VDU 23,146,&2E,&62,&22,&2E,&28,&28,&2E,0
200 VDU 23,147,&3C,&20,&20,&3C,4,4,&3C,0
210 VDU 23,148,&82,&44,&38,&38,&38,&44,&82,0
220 VDU 23,149,0,0,&F,&FF,&F,0,0,0
230 VDU 23,150,&C,&1E,&30,&FF,&30,&1E,&C,0
240 VDU 23,151,0,0,&2E,&22,&EE,&AA,&EE,0
250 VDU 23,152,0,0,&D3,&9A,&93,&91,&9B,0
260 VDU 23,153,0,&45,&45,&77,&51,&77,0,0
270 VDU 23,154,0,5,5,&1D,&15,&1D,0,0
280 VDU 23,155,0,&DC,&54,&DC,4,&1C,0,0
```

DARTS IS A GAME for the BBC model B or 32K model A, and although not tested will probably work on an Electron.

The game of darts once only played in its traditional home of the pub and club is now an international sport frequently seen on television. It is one of the most popular participant sports in this country, and indeed the world, played by millions.

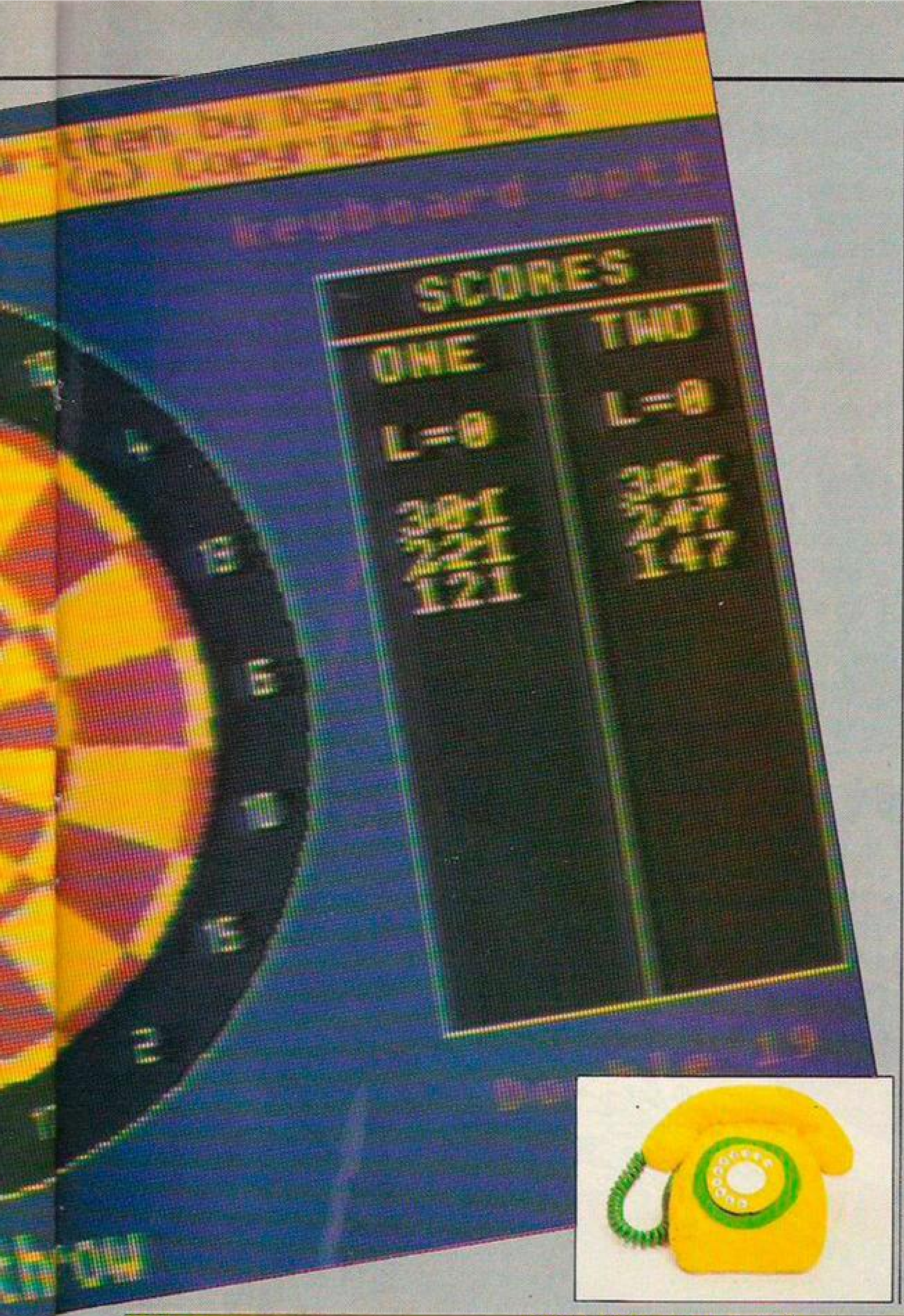
My computerised version is by no means a substitute for throwing arrows from the oche down at your local but an alternative to arcade-type games requiring manipulation of at least 11 of your fingers and very quickly, a feat not suitable for some of the more elderly BBC users!

It is difficult to emulate the same skills of the darts game proper on a computer game and so the method of aiming and throwing darts I have employed is to manoeuvre a crosshair sight over the board, throwing a dart when it is over the place you want. A skill element is introduced with the sight drifting and so making it more difficult to hit the number you require. The game was written with joysticks in mind although I have provided for keyboard use.

There are three different games to play in my program, the standard game, around the clock and all fives. All are for two players.

The standard game — options 1 and 2 on the main menu: Option 1 provides a standard 301 game with double start and double to finish, played over five legs, i.e., the first to win three games wins the match. The difficulty level decides how much the sight drifts, level 1 is the easiest.

After the board has been drawn both players should enter their initials or three lettered



pseudonym. The scoreboard shows initials, how many legs each has won — shown by 'L =' — and the score required for this game.

As each dart has been thrown the display to the bottom right of the screen shows what it has scored.

Option 2 allows the parameters to be altered, giving games such as 801 straight off over 3 legs and 101 double start over 9 legs.

Around the clock — option 3: In this game each player goes around the board, throwing at 1 until hit and then at the 2 etc. and ending on the outer bull — 25 — and then the bull's eye — 50. It is possible to aim for singles, doubles or trebles depending on your initial choice. The score-board shows what each player must throw for next, with sgl, dbl or tbl printed under initials.

All fives — options 4 and 5: Option 4 gives the standard all fives game. Each player must score a multiple of five for his three dart total throw, for example: 55, 25 etc. If he misses the board with one of his darts the throw is not counted. Then the number of fives scored is calculatled, that being his score for that throw — a score of 45 counts as 9, 10 as 2 etc. — and taken from his initial 51 points. A throw resulting in a score that is not a multiple of five is not allowed. The match is over five legs.

Option 5 allows parameters to be changed, so the game can become all threes or all eights etc.

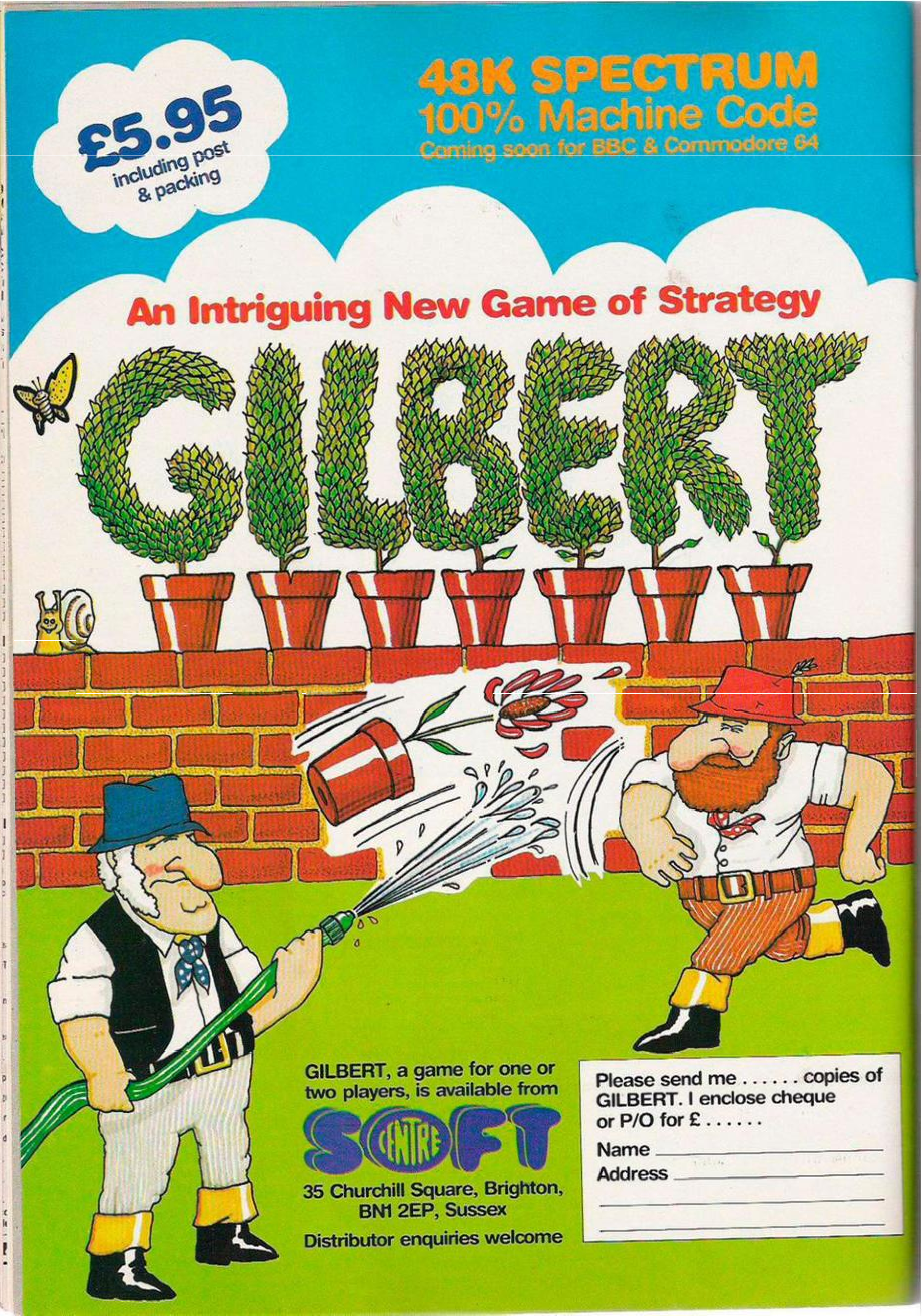
An unusual feature in the programming of darts is the use of two Basic programs resident in the machine at the same time, the main game — listing 4 — and a routine to draw the dart-board — listing 3. The reason for this was to allow myself an extra three pages of programming space. The memory soon got full while developing the game although relocating Page to &D000. I couldn't start the Basic program below this because of the user-defined characters stored between &C00 and &CFF, so I chopped part of the main program off and stored it between &900 and &BFF, this area is free when files, RS-423 and function keys are not used. Then Page only needs to be changed to pass control from one program to the other. See line 60 of listing 3 and line 80 of listing 4.

To enter the program and store it on cassette in the correct order, the following procedure should be followed:

- type in listing 1
- save with 'SAVE "DARTS" (RETURN) (RETURN)'
- type in listing 2 and RUN it

(continued on page 151)

Table 1.	
10 to 150	main control program 80 jumps to small program stored between &900 and &BFF to draw dartboard
160 to 550	standard game and all fives routine 330 all fives missed a dart 360 all fives not a multiple of five 380 fanfare on 180 400 cross off old score
560 to 860	Around the clock routine 770 hit bull's eye 780 hit outer bull 810 cross off old score and print new score
870 to 950	get players' names
960 to 1030	get word at position (X,Y) of length L
1040 to 1060	open text window for player P's socreboard
1070 to 1090	close above windows
1100 to 1240	throw three darts routine 1110 print marker darts 1190 check for individual game end of throw 1210 to 1230 rub out darts
1250 to 1480	throw a dart 1270 to 1350 move sights until fire pressed 1380 print dart 1390 work out distance and angle of dart from the centre of the board 1410 find which number dart has hit
1490 to 1510	see if space bar or fire pressed to throw a dart
1520 to 1570	get movement of sight from keyboard or joystick
1580 to 1680	additional trimming for dartboard display
1690 to 1770	set up variables and arrays 1720 to 1740 put SINs and COSs in arrays for fast circle drawing 1750 to 1760 order of numbers around dartboard
1780 to 1880	draw sight
1819 to 1910	print M$ in double height at (X,Y) in colour C 1850 see User Guide p462
1920 to 1940	wipe out n characters at (x,y)
1950 to 1970	delay for t seconds
1980 to 2020	print 'press space bar'
2030 to 2410	instructions and menus
2420 to 2450	get key but only one of those characters supplied by K$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(continued from page 149)

- type 'PAGE = &900 (RETURN)'
- type in listing 3
- save with '*SAVE "darts" 900 DOO (RETURN) (RETURN)'
- type 'PAGE = &D00 (RETURN)'
- type in listing 4
- save with 'SAVE "darts . . ." (RETURN) (RETURN)'

Important — omit lines 1, 2 and 3 from each program.

I would advise saving listing 2 on a back up cassette. In case of deformed characters it will be possible to track them down and repair them.

It would be helpful to replace line 10 of listing 4 with

10MODE7:ON ERROR MODE7:REPORT: PRINT "at line";ERL:END

while the game is developed to trap any typing errors.

For a complete working copy, without the effort and strain of a couple of hours at the keyboard, send £3.75 or £2.75 plus blank cassette plus S.A.E. to David Griffin, 31 Apsley Road, Oldbury, Warley, West Midlands B68 0QY. The game is also available on Prestel via the pages of Viewfax 258.

Listing 3.

```
    1 REM Listing 3
    2 REM BBC Darts  -  by David Griffin
    3
   10COLOUR2:COLOUR131:VDU31,6,1,149,150,31,5,2,149,15
0,5:GCOL0,2:MOVE80,972:VDU149,150:GCOL0,1:$&2FE0="writ
ten by David Griffin":FORI%=0TO23:MOVE624+I%*24,988:VD
UI%?&2FE0:NEXT:$&2FE0="(c) Copyright 1984"
   20FORI%=0TO17:MOVE696+I%*24,956:VDUI%?&2FE0:NEXT:CO
LOUR128:VDU29,440;512;
   30PROCC(388,2,2):GCOL0,3:MOVE0,388:FORI%=0TO40:DRAW
388*S(I%),388*C(I%):NEXT:PROCC(300,1,3):PROCC(280,3,1)
:PROCC(184,1,3):PROCC(164,3,1):PROCC(32,0,0):PROCC(12,
1,1)
   40GCOL0,3:FORI%=0TO38STEP2:MOVE340*S(I%)-16,340*C(I
%)+16:VDU128+I%DIV2:NEXT:GCOL0,1:MOVE-32,332:VDU151,15
2:MOVE-44,-300:VDU153,154,155,29,0;0;:GCOL0,2:MOVE896,
200:DRAW1248,200:PLOT85,896,832:PLOT85,1248,832
   50GCOL0,3:MOVE896,200:DRAW1248,200:DRAW1248,832:DRA
W896,832:DRAW896,200:MOVE976,816:PRINT"SCORES":VDU4:MO
VE896,776:DRAW1248,776:MOVE1072,776:DRAW1072,200
   60PAGE=&D00:GOTO90
   70DEFPROCC(R%,C%,D%):D%=C%+D%:GCOL0,C%:MOVE0,R%:FORI
%=1TO40:IF(I%+1)MOD2C%=D%-C%:GCOL0,C%
   80DRAW0,0:PLOT85,R%*S(I%),R%*C(I%):NEXT:ENDPROC
```

Listing 4.

```
    1 REM Listing 4
    2 REM BBC Darts  -  by David Griffin
    3
   10MODE7:ON ERROR RUN
   20g=FNinstr
   30MODE 1
   40VDU 23;8202;0;0;0;19,0,4,0,0,0,19,2,0,0,0,0,19,3,
3,0,0,0
   50PROCboard
   60PROCSET
   70*FX200 1
   80PAGE=&900:GOTO10
   90*FX200 0
  100IF g=1 PROCSgame(301,1,3,H)
  110IF g=2 PROCSgame(S,D,L,H)
  120IF g=3 PROCAclock
  130IF g=4:g5=5:PROCSgame(51,0,3,H)
  140IF g=5:g=4:g5=5:PROCSgame(51,0,L,H)
  150RUN
  160DEFPROCSgame(G,SD,L,H)
  170PROCSnames
  180Pleg(0)=0:Pleg(1)=0:P1=RND(2)-1:LEG=0
  190REPEAT
  200LEG=LEG+1
  210FOR P=0 TO 1
  220PS(P)=G:start(P)=SD
  230COLOUR130:PRINTTAB(29+P*6,10)"L=";Pleg(P);
  240SV(P)=0:PROCwndo(P):CLS:PRINT;PS(P);
  250PROCwoff(P)
  260NEXT
  270P1=1-P1:P=P1
  280REPEAT
  290P=1-P
  300PROCw(13,8,29)
  310PROCm(PN$(P)+" to throw",10,29,3)
  320sc=FNdarts(H)
  330IF g=4 sc=sc/g5:IF s=0 PROCm("MISSED ONE",33,28,3
):PROCdel(1):PROCw(10,29,28):GOTO 440
  340IF ((start(P)=1 AND dbl=0)OR(PS(P)-sc=0 AND dbl=0
))AND g<>4 PROCm("NO DOUBLE",34,28,3):PROCdel(1):PROCw
(10,29,28):GOTO 440
  350IF (PS(P)-sc=1 AND g<>4) OR PS(P)-sc<0 PROCm("GON
E BUST",34,28,3):PROCdel(1):PROCw(10,29,28):GOTO 440
  360IF g=4 AND sc<>INTsc PROCm("NOT "+STR$(g5)+"s",35
,28,3):PROCdel(1):PROCw(10,29,28):GOTO 440
  370IF sc=0 GOTO440
  380IF sc=180 SOUND 1,1,60,50
  390PROCm("Score="+STR$(sc),34,28,3)
  400GCOL0,3:MOVE(29+P*6)*32,(20-SV(P))*32:DRAW(29+LEN
(STR$(PS(P)))+P*6)*32-8,(21-SV(P))*32-4
  410PS(P)=PS(P)-sc
  420PROCwndo(P):PRINT;PS(P);:IF PS(P)<100 PRINT
  430PROCwoff(P)
  440UNTIL PS(0)=0 OR PS(1)=0
  450PROCw(13,8,29):PROCw(9,29,28)
  460IF LEG=1 M$="st" ELSE IF LEG=2 M$="nd" ELSE IF LE
G=3 M$="rd" ELSE M$="th"
  470PROCm(PN$(P)+" won the "+STR$(LEG)+M$+" leg",8,29
,3)
  480Pleg(P)=Pleg(P)+1
  490COLOUR130:PRINTTAB(29+P*6,10)"L=";Pleg(P);
  500PROCdel(2):PROCw(40,0,29)
  510UNTIL Pleg(0)=L OR Pleg(1)=L
  520PROCm(PN$(P)+" won the match",3,29,3)
  530PROCm("Play again (Y/N) ...",24,29,1)
  540IF(FNget("YyNn")+1)DIV2=1:PROCw(40,0,29):GOTO180
  550ENDPROC
  560DEFPROCAclock
  570PROCSnames
  580FOR P=0 TO 1:PS(P)=1
  590COLOUR130:COLOUR3:VDU31,29+P*6,10:IF S=1 PRINT"sg
l":ELSE IF S=2 PRINT"dbl":ELSE PRINT"tbl"
  600PROCwndo(P):CLS:PRINT;PS(P):PROCwoff(P)
  610NEXT
  620P=RND(2)-1
  630REPEAT
  640P=1-P
  650PROCw(13,8,29):PROCm(PN$(P)+" to throw",10,29,3)
  660sc=FNdarts(H)
  670N=PS(P)
  680FORT=0TO2
  690IF PS(P)>20 GOTO750
  700IF PS(P)=0 GOTO800
  710M$=LEFT$(throw$(T),1)
  720IF S=2 AND M$<>"D" GOTO800
  730IF S=3 AND M$<>"T" GOTO800
  740IF S=1 AND(M$="D" OR M$="T")GOTO800
  750S$=RIGHT$(throw$(T),2)
  760IF VAL(S$)=PS(P):PS(P)=PS(P)+1
  770IF S$="YS" AND PS(P)=50 PS(P)=0
  780IF S$="LL" AND PS(P)=25 PS(P)=50
  790IF PS(P)=21 PS(P)=25
  800NEXT
  810IF PS(P)>N OR PS(P)=0 GCOL0,3:MOVE(29+P*6)*32,(20
-SV(P))*32:DRAW(31+P*6)*32-8,(21-SV(P))*32-4:PROCwndo(
P):PRINT;PS(P):PROCwoff(P)
  820UNTIL PS(P)=0
  830PROCw(40,0,29):PROCm(PN$(P)+" won the match",3,29
```

(continued on page 153)

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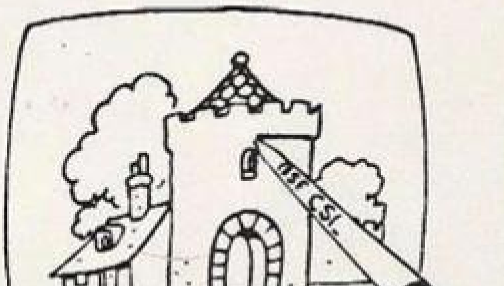

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(continued from page 151)

```
,3)
 840PROCm("Play again (Y/N) ...",24,29,1)
 850IF(FNget("YyNn")+1)DIV2=1:PROCw(40,0,29):GOTO580
 860ENDPROC
 870DEFPROCnames
 880FOR P=0 TO 1
 890PROCm("Please type Player "+STR$(P+1)+"'s initial
s ...",3,29,3)
 900COLOUR3
 910PN$(P)=RIGHT$("  "+FNword(34,29,3),3)
 920PROCw(40,0,29)
 930COLOUR130:PRINTTAB(29+P*6,8)PN$(P):COLOUR128
 940NEXT
 950ENDPROC
 960DEFFNword(X,Y,L)
 970*FX 15 0
 980VDU31,X,Y:N$="":REPEAT A=GET
 990SOUND 1,-15,RND(10)*4+100,3
 1000IF A>31 AND A<122 AND LEN(N$)<L VDUA:N$=N$+CHR$A
 1010IF A=127 AND LEN(N$)>0 VDU127:N$=RIGHT$(N$,LEN(N$
)-1)
 1020UNTIL A=13 AND LEN(N$)>0
 1030=N$
 1040DEFPROCwndo(P)
 1050VDU 28,29+P*6,24,31+P*6,12,31,0,SV(P):COLOUR130:C
OLOUR3
 1060ENDPROC
 1070DEFPROCwoff(P)
 1080SV(P)=VPOS:COLOUR128:VDU26
 1090ENDPROC
 1100DEFFNdarts(H)
 1110dbl=0:COLOUR1:FOR Y=27 TO 29:PRINTTAB(29,Y)"     "
CHR$149CHR$150"     ":NEXT
 1120SCORE=0:T=-1:X%=RND(400)+248:Y%=RND(400)+312
 1130REPEAT T=T+1
 1140throw$(T)=FNthrow(H)
 1150X(T)=X%-12:Y(T)=Y%+12
 1160IF start(P)=1 AND dbl=1 start(P)=0
 1170IF start(P)=0 SCORE=SCORE+s
 1180PRINTTAB(34-(LEN(s$)/2),27+T)throw$(T)
 1190UNTIL T=2 OR(PS(P)-SCORE<2 AND g<>4 AND g<>3)OR(g
=4 AND s=0)OR(PS(P)-SCORE/g5<0 AND g=4)OR(g=3 AND PS(P
)=50 AND throw$(T)="BULL'S EYE")
 1200PROCdel(1):PROCw(10,29,27):PROCw(10,29,29)
 1210VDU5:FOR D=0 TO T
 1220GCOL3,3:MOVEX(D),Y(D):VDU148
 1230NEXT:VDU4
 1240=SCORE
 1250DEFFNthrow(H)
 1260s$="":press=1
 1270REPEAT IF NOT FNfire press=0
 1280PROCsight
 1290PROCdel(.01)
 1300PROCsight
 1310PROCkJ
 1320X%=X%+(RND(16*H+1)-(8*H+1)):Y%=Y%+(RND(16*H+1)-(8
*H+1))
 1330IF X%>848 X%=78 ELSE IF X%<48 X%=798
 1340IF Y%>912 Y%=162 ELSE IF Y%<112 Y%=862
 1350UNTIL FNfire AND press=0
 1360SOUND0,2,5,4:PROCdel(.4):SOUND1,-15,0,1
 1370VDU31,33,27+T,32,32
 1380GCOL3,3:VDU5:MOVE X%-12,Y%+12:VDU148,4
 1390x=X%-448:y=Y%-512:r=SQR(x^2+y^2):a=DEG(ACS(x/r))
 1400IF y<0 a=360-a
 1410s=A(((459-a)MOD360)DIV18)
 1420s$=STR$(s)
 1430IF r<=32 s$="outer BULL":s=25
 1440IF r<=12 s$="BULL'S EYE":s=50:dbl=1
 1450IF r>=164 AND r<184 s$="Treble "+s$:s=s*3
 1460IF r>280 AND r<=300 s$="Double "+s$:s=s*2:dbl=1
 1470IF r>300 s$="Missed":s=0
 1480=s$
 1490DEFFNfire Z=FALSE
 1500IF(J=1 AND((ADVAL(0)AND 3)=P+1))OR(J=2 AND INKEY-
99)Z=TRUE
 1510=Z
 1520DEFPROCkJ
 1530IF(J=1 AND ADVAL(P*2+1)>40000)OR(J=2 AND INKEY-98
)X%=X%-16
 1540IF(J=1 AND ADVAL(P*2+1)<20000)OR(J=2 AND INKEY-67
)X%=X%+16
 1550IF(J=1 AND ADVAL(P*2+2)>40000)OR(J=2 AND INKEY-73
)Y%=Y%+16
 1560IF(J=1 AND ADVAL(P*2+2)<20000)OR(J=2 AND INKEY-10
5)Y%=Y%-16
 1570ENDPROC
 1580DEFPROCboard
 1590GCOL0,3:MOVE0,924:DRAW1280,924:PLOT85,0,992:PLOT8
5,1280,992
 1600GCOL0,2:MOVE0,920:DRAW1280,920:MOVE0,996:DRAW1280
,996
 1610VDU23,158,2,7,7,&7F,&FF,&E7,&FF,&7E:PROCm(CHR$158
,12.2,1,0)
 1620VDU23,158,&7E,&FF,7,&7F,&FF,&E7,&FF,&7E:PROCm(CHR
$158,13.7,1,0)
 1630VDU23,158,&46,&CF,&FF,&F9,&F0,&F0,&60,&60:PROCm(C
HR$158,15,1,0)
 1640VDU23,158,&20,&70,&70,&FC,&FE,&70,&7F,&3E:PROCm(C
HR$158,16.3,1,0)
 1650VDU23,158,&7E,&FF,&E0,&FE,&7F,7,&FF,&7E:PROCm(CHR
$158,17.6,1,0)
 1660COLOUR1:VDU31,26,4:IF J=1 PRINT"joystick";ELSE PR
INT"keyboard";
 1670PRINT" opt";g
 1680ENDPROC
 1690DEFPROCSET
 1700DIMS(40),C(40),A(19),X(2),Y(2),PN$(1),PS(1),SV(1)
,start(1),Pleg(1),throw$(2)
 1710g5=5:ENVELOPE1,0,10,30,3,100,100,100,126,0,0,-1,1
26,60:ENVELOPE2,1,0,0,0,0,0,0,5,10,-1,-5,10,100
 1720FOR I%=0 TO 40
 1730S(I%)=SIN(RAD(I%*9)):C(I%)=COS(RAD(I%*9))
 1740NEXT
 1750FOR I%=0 TO 19:READA(I%):NEXT
 1760DATA20,1,18,4,13,6,10,15,2,17,3,19,7,16,8,11,14,9
,12,5
 1770ENDPROC
 1780DEFPROCsight
 1790GCOL3,1:MOVEX%-32,Y%:DRAWX%+32,Y%:MOVEX%,Y%-32:DR
AWX%,Y%+32
 1800ENDPROC
 1810DEFPROCm(M$,X,Y,C)
 1820VDU5:GCOL0,C
 1830FOR I%=1 TO LENM$
 1840?&70=ASC(MID$(M$,I%,1))
 1850X%=&70:Y%=0:A%=&A:CALL&FFF1
 1860L%=&71
 1870FOR J%=0 TO 1:VDU23,255
 1880FOR K%=1 TO 4:VDU?L%,?L%:L%=L%+1:NEXT
 1890MOVE(X+I%-1)*28,(32-(Y+J%))*32-4:VDU255
 1900NEXT,:VDU4
 1910ENDPROC
 1920DEFPROCw(n,x,v)
 1930COLOUR128:FOR y=v TO v+1:PRINTTAB(x,y)SPC(n);:NEX
T
 1940ENDPROC
 1950DEFPROCdel(t)
 1960tt=TIME:REPEAT UNTIL TIME=tt+t*100
 1970ENDPROC
 1980DEFPROCpspace
 1990*FX15 1
 2000VDU31,0,23,131,157,148:PRINTSTRING$(8,",")CHR$129
"Press SPACE BAR"CHR$148STRING$(9,",")"  "CHR$156TAB(2
7,23);
 2010REPEAT UNTIL GET=32
 2020ENDPROC
 2030DEFFNinstr
 2040FOR I=0 TO 4:VDU31,4,I,132,157,146,31,34,I,156:NE
XT
 2050PRINTTAB(8,1)"***"CHR$255" m)_&+t"""CHR$255" k47k7
ph7'e"TAB(9,2)CHR$255" j5)!!"CHR$255" "CHR$255",v' j5
""-,t"TAB(8,3)" "CHR$255"p>'z0_"CHR$255"p"CHR$255"0+u
zu +tp?"TAB(2,6)CHR$129"(c) Copyright David Griffin 19
84"
 2060PRINTTAB(4,9)"Move the sight around the board"TAB
(5)"and throw a dart when it is"TAB(7)"over the number
 you want"
 2070PRINTTAB(8,17)CHR$134"Joysticks ? (Y/N) ...";
 2080J=(FNget("YyNn")+1)DIV 2
 2090PRINTTAB(8,17)SPC(22)
 2100IF J=2 PRINTTAB(11,13)CHR$134"* ... move UP"TAB(1
1)CHR$134"/ ... move DOWN"TAB(11)CHR$134"Z ... move LE
FT"TAB(11)CHR$134"X ... move RIGHT"TAB(7)CHR$134"SPACE
 ... throw a dart";
 2110IF J=1 PRINTTAB(8,15)CHR$134"FIRE ... throw a dar
t";
 2120PRINT''TAB(6)CHR$134"ESCAPE ... reset"
 2130PROCpspace:VDU28,0,23,39,9,12,26
 2140PRINTTAB(7,10)CHR$131"1 ... Standard 301 game"TAB
(7)CHR$131"2 ... Standard game"TAB(12)CHR$131"(you cho
ose parameters)"TAB(7)CHR$131"3 ... Around the clock"T
AB(7)CHR$131"4 ... All fives"TAB(7)CHR$131"5 ... As op
tion 4"
 2150PRINTTAB(12)CHR$131"(you choose parameters)"TAB(5
,20)"Please press the number of the"TAB(9)"game you wa
nt to play ";
 2160*FX15 0
 2170G=FNget("12345")
 2180VDU28,0,23,39,9,12,26
 2190IF G<>3 GOTO2210
 2200IF G=3 PRINTTAB(5,11)CHR$131"Singles,doubles"'TAB
(5)CHR$131"or trebles ? ........"TAB(0,13):GOTO2270
 2210IF G<>2 AND G<>5 VDU31,0,11:GOTO2270
 2220IF G=5 VDU28,0,23,39,1
 2230PRINTTAB(5,9)CHR$131"Which game ? ........"TAB(5)
CHR$131;
 2240IF G=2 PRINT"(101,301 etc..)"TAB(5,12)CHR$131"Dou
ble to start ? ..."TAB(5)CHR$131"(YES/NO)"
 2250IF G=5 PRINT"(4s,7s etc..)"
 2260PRINT'TAB(5)CHR$131"No. of legs in"'TAB(5)CHR$131
"each match ? ........"TAB(5)CHR$131"(3,5,7 or 9)"
 2270PRINT'TAB(5)CHR$131"Difficulty level ? .."TAB(5)C
HR$131"(1-3)".
 2280*FX15
 2290IF G<>3 GOTO2320
 2300VDU31,27,12,132:S=(FNget("SsDdTt")+1)DIV 2:IF S=1
 PRINT"SINGLES":ELSE IF S=2 PRINT"DOUBLES":ELSE PRINT"
TREBLES"
 2310VDU31,27,15,132:GOTO2390
 2320IF G<>2 AND G<>5 VDU31,27,12,132:GOTO2390
 2330VDU31,27,9,132:IF G=2 S=FNget("123456789")*100+1:
ELSE S=FNget("3456789")+2
 2340PRINT;S;:IF G=5 PRINT"s":VDU31,27,13,132:GOTO2370
 2350VDU31,27,12,132:D=(FNget("YyNn")+1)DIV2:IF D=1 PR
INT"YES":D=1:ELSE PRINT"NO":D=0
 2360VDU31,27,16,132
 2370L=FNget("3579"):PRINT;L*2+1:L=L+1
 2380IF D=2 VDU31,27,19,132:ELSE VDU31,27,16,132
 2390H=FNget("123"):PRINT;H
 2400VDU26:PROCpspace
 2410=G
 2420DEFFNget(K$)
 2430*FX15 1
 2440REPEAT K=INSTR(K$,GET$):SOUND1,-15,RND(10)*4+100,
3:UNTIL K<>0
 2450=K
```


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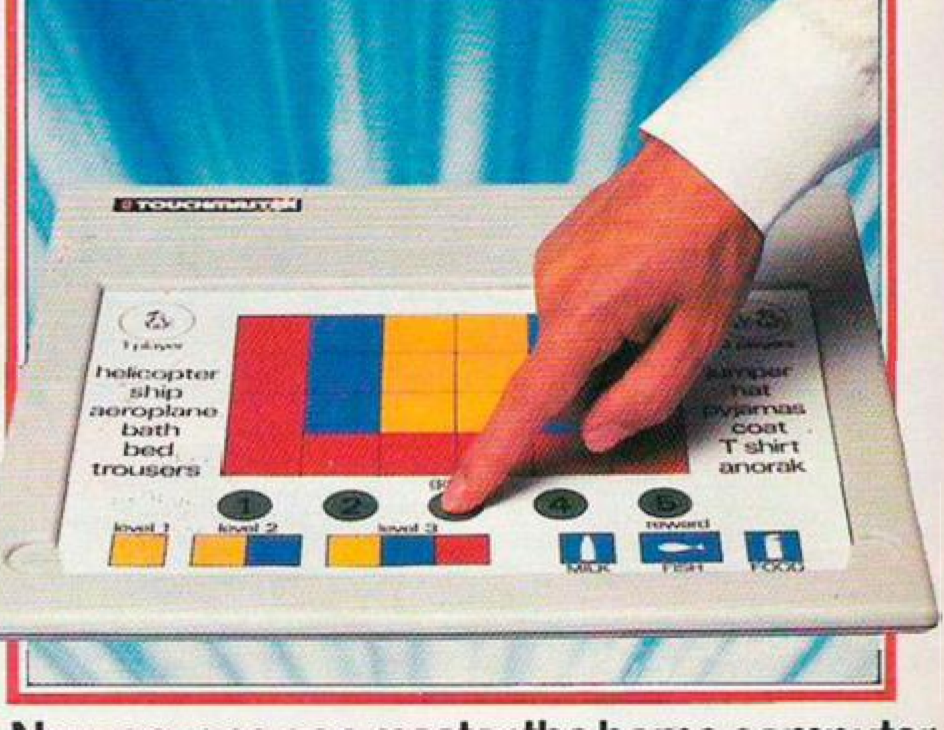

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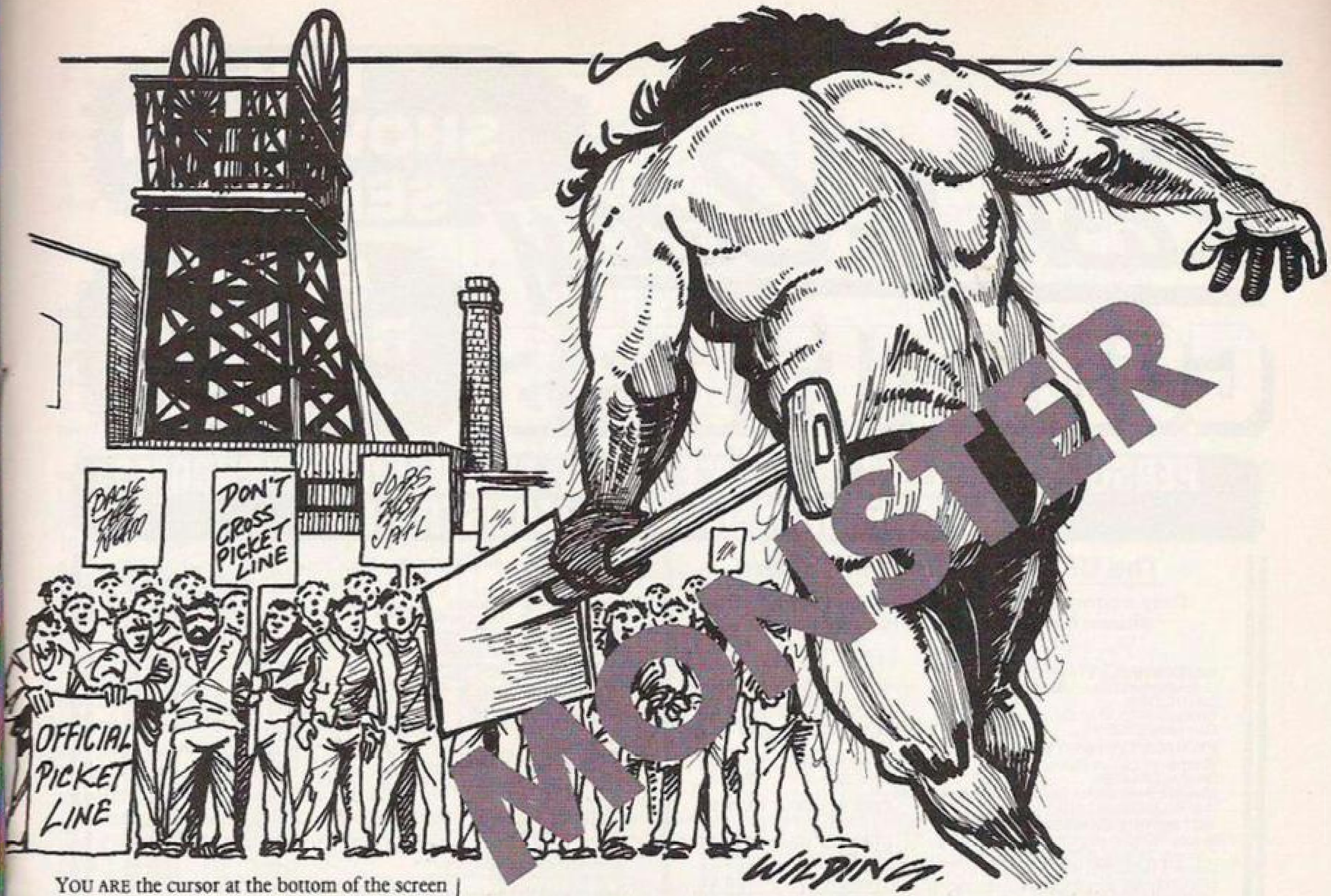

MONSTER DIGGER

Michael Pike traps monsters in holes on his ZX-81 with 16K expansion.

YOU ARE the cursor at the bottom of the screen and you have to run up and down the ladders avoiding the mutants, digging holes and dropping the mutants through them before your oxygen runs out. You are given a fresh supply of oxygen each screen and the number of mutants gradually increases as the screens are completed to a maximum of eight. A full list of the keys used for movement is given in the Basic program before the game starts.

You can dig holes on any level except the bottom line and you are not allowed to dig two holes right by each other or dig next to a ladder. You cannot dig or fill while on a ladder as you will only move up or down it. To dig you press one of the down keys and a hole will appear next to your right or left depending on which way the cursor is pointing. Holes can be filled in using one of the up keys but will not work if there is a mutant in the hole.

To push a mutant through a hole move over it and jump using an up key. If you wait too long the mutant will start to flash showing you that it is about to pull itself up and mutate further into a stronger life form. There are three types of mutants of increasing strength — S,$ and inverse $, points 50, 100, 200. A $ and inverse $ have to be dropped through 2/3 holes to kill them straight away and to obtain the full points or you can drop them through a lesser number of levels to weaken them but you do not get as many points. Also you can drop through the holes to escape the mutants.

The machine code is contained in a Rem statement in line 0 containing at least 2800 spare characters. The code is between addresses 16514 to 19314. To obtain a Rem statement of this size type:

1 REM 320 0s or any other single character

(continued on page 157)

Basic program.

```
   5 REM [illegible]
  10 PRINT AT 1,5;"DIGGER FOR 16K ZX81"
  15 PRINT AT 4,2;"CONTROLS";AT 6,2;"LEFT";AT 6,25;"Q-T";AT 8,2;"RIGHT";AT 8,25;"Y-P";AT 10,2;"UP/FILL/JUMP";AT 10,25;"1-5";AT 12,2;"DOWN/DIG";AT 12,25;"A-G"
  20 PRINT AT 14,2;"POINTS";AT 15,10;"S .... 50";AT 16,10;"$ .... 100";AT 17,10;"$ .... 200"
  25 PRINT AT 19,6;"HIGH SCORE RESET Y/N"
  30 IF INKEY$<>"" THEN GOTO 30
  35 LET A$=INKEY$
  40 IF A$="" THEN GOTO 35
  45 IF A$<>"Y" THEN GOTO 60
  50 POKE 16608,0
  55 POKE 16609,0
  60 LET L=USR 16778
 100 STOP
```

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*Please Delete

(continued from page 155)

This is 10 full lines of zeroes exactly. Edit this and change it to line 2, edit this and change it to line 3 and so on until you have lines 1 to 9 in this way — each line having 320 characters. Now type:

```
POKE 16511,114
POKE 16512,11
POKE 16510,0
```

Do not return to the listing when typing these Pokes as this will cause a crash but type them one after the other until finished and then you can look at the listing. You should have one Rem-statement of 2816 characters including the Rem and Newline characters, more than enough to hold the code.

Enter the machine code in the hex dump using any hex loader, the start address is 16514 and the finish is 19314. Save this on tape a few times when finished. Now enter the Basic lines 10 to 100. Press Rand Newline as if you do not do this the mutants do not move randomly for some unknown reason and will probably refuse to fall into the holes, then Run. If the game crashes you have to type in a hex checker program and check all the code.

One more thing to note — never type in the line number of the line immediately after the Rem as this will cause line 0 to be listed again and again by the computer due to a bug in the Rom. Therefore type in line 10 of the Basic program before you erase the hex loader.

Hex loader.

```
 99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N;" - ";
170 INPUT A$
180 PRINT A$;" = ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=T THEN GO TO 310
290 PRINT "ERROR - PLEASE INPUT
AGAIN"
300 GO TO 150
310 NEXT N
```

If you master the game too quickly there are two Pokes you can enter to make the game harder.

Poking 18750 will cause the oxygen to decrease at a different rate — it is presently set at 3. Poking with 0 will make the oxygen stay at 6000.

Poking 18899 will change the speed of the game — this is initially set to 6.

The hex codes between 16608 and 16668 are data bytes and change during the running of the program and need not be 00.

Hex dump.

```
16514 - E5D52A3240545D29 = 816
16522 - 2919292929192232 = 298
16530 - 407CD1E1C980ADAE = 1298
16538 - ACAD80B8A8B4B7AA = 1358
16546 - 949C9C9C9C9C9C80 = 1212
16554 - B4BDBEACAAB394A2 = 1390
16562 - 9C9C9C8080808080 = 1108
16570 - B5B1A6BEAAB78088 = 1379
16578 - A8B4B7AA949C9C9C = 1317
16586 - 9C9C9C8052AAB394 = 1271
16594 - 9C80808080ACA6B2 = 1184
16602 - AA8054B8AAB70000 = 1013
16610 - 0000000000000000 = 0
16618 - 0000000000000000 = 0
16626 - 0000000000000000 = 0
16634 - 0000000000000000 = 0
16642 - 0000000000000000 = 0
16650 - 0000000000000000 = 0
16658 - 0000000000000000 = 0
16666 - 0000002101001415 = 75
16674 - 260A7DC6216F7CCE = 847
16682 - 006718F39C0019ED = 788
16690 - 5B0C4019C9C579CB = 914
16698 - 6F2005E61F831805 = 569
16706 - E61F4F78915FC1CB = 1099
16714 - 792005CB712003C9 = 710
16722 - 14C915C9CD1D41EB = 977
16730 - 6069011027CD7B41 = 650
16738 - 01E603CD7B410164 = 730
16746 - 00CD7B41010A00CD = 609
16754 - 7B41010100CD7B41 = 583
16762 - C93E9BC6003CED42 = 979
16770 - 30FB09EB77EB13C9 = 1117
16778 - 2A0C4011D7021911 = 394
16786 - 9740EB012000ED80 = 896
16794 - 01200013ED802100 = 498
16802 - 0022E24021E44036 = 703
16810 - 0321E74036012170 = 531
16818 - 1722E540111A1601 = 416
16826 - 7017CD5641111B17 = 558
16834 - CD1D413AE440C69C = 1003
16842 - 77ED4BE040110C16 = 770
16850 - CD56410E162A0C40 = 510
16858 - 062023360010FB23 = 429
16866 - 0D20F52A0C401143 = 492
16874 - 00190E0406203680 = 263
16882 - 2310F5118500190D = 490
16890 - 20F221E840061836 = 687
16898 - 002310FB21E84036 = 685
16906 - 0111020019E5CD82 = 609
16914 - 40E6012801233601 = 426
16922 - E111030019360118 = 352
16930 - 230603E5CD8240E6 = 902
16938 - 012801233601E119 = 382
16946 - 10F10602C5010600 = 469
16954 - E5E5C600ED427EED = 1322
16962 - 4246E1FE01201F80 = 807
16970 - FE022819E5230106 = 592
16978 - 00C600ED427EED42 = 930
16986 - 86FE02E12808CD82 = 998
16994 - 40E6012801233601 = 426
17002 - E119E5E5010600C6 = 913
17010 - 00ED427EED4286FE = 1120
17018 - 02E12816E523C600 = 751
17026 - ED427EED4286E1FE = 1345
17034 - 022808CD8240E601 = 680
17042 - 2801233601E119E5 = 610
17050 - E505C600ED427E03 = 870
17058 - ED4246E1FE01201D = 914
17066 - 80FE022819E50106 = 685
17074 - 00C600ED427EED42 = 930
17082 - 86FE02E12807CD82 = 997
17090 - 40E6012801233601 = 426
17098 - E119C105C236422A = 804
17106 - 0C401144001911E8 = 435
17114 - 400E040606C5D5E5 = 733
17122 - EB7EEBFE01202B78 = 1046
17130 - FE05281CFE012814 = 643
17138 - CD8240E603F5CD82 = 1212
17146 - 40E60147F1804F06 = 820
17154 - 0009180401040009 = 51
17162 - 0605362D11210019 = 185
17170 - 10F8E111050019D1 = 745
17178 - 13C110C1D5118700 = 786
17186 - 19D10D20B6110015 = 499
17194 - CD1D410620368023 = 554
17202 - 10FB21E7407EFE05 = 980
17210 - 38023E05C6034721 = 430
17218 - E9401100010E00C5 = 526
17226 - C5CD8240E607D54F = 1125
17234 - CD374173237223E5 = 853
17242 - CD1D417EE1FE2D28 = 989
17250 - 04C600180137D1C1 = 684
17258 - CB19C578FE052807 = 851
17266 - 0E08CD3741180311 = 391
17274 - 0008C110C5211141 = 533
17282 - 51C13E089047FE00 = 813
17290 - 2808C600CB1A10FA = 739
17298 - 7221E7407EFE0716 = 851
17306 - FA1EFA3008FE0630 = 892
17314 - 081817CD8240E607 = 691
17322 - 5FCD8240E60757B8 = 1005
17330 - 20083CFE0838023E = 482
17338 - 0057141C21F94006 = 487
17346 - 087A882004364018 = 492
17354 - 0A7B882004364018 = 495
17362 - 0236002310EB0608 = 356
17370 - 210141CD8240E603 = 731
17378 - 772310F7110F14ED = 706
17386 - 531241CD1D417EFE = 845
17394 - 2D21114120043E01 = 262
17402 - 18023E007721E740 = 535
17410 - 7EFE0538023E05C6 = 708
17418 - 0347C5180037CB1A = 577
17426 - 10F6C13E089047FE = 999
17434 - 002806C600CB1A10 = 489
17442 - FA21E84072C30E49 = 975
17450 - 21E840460E00235E = 542
17458 - 235623CB18E5D5C5 = 1022
17466 - 380CC1D1E10C79FE = 1082
17474 - 0820EC3E00C914CD = 764
17482 - 1D417EFE00C2E044 = 960
17490 - 21F9400600097EE6 = 717
17498 - 3FFE023803C33C44 = 701
17506 - FE01CA72447E3C77 = 944
17514 - C1D1D5C514C36D46 = 1205
17522 - 211541097E3C77FE = 687
17530 - 3CC29F44C1D1D5C5 = 1293
17538 - CD1D41368021F940 = 827
17546 - 0600097EFE403004 = 511
17554 - 3E4018023E8077C1 = 654
17562 - D115C38246211441 = 791
17570 - CB55CA3C442A1241 = 744
17578 - C1D1D5C5C6001516 = 1052
17586 - ED52C23C44210941 = 748
17594 - 0600097E3C77FE06 = 580
17602 - C23C44C1D1D5C5CD = 1339
17610 - 1D41368021F94006 = 628
17618 - 00097EE6C0C60277 = 876
17626 - C1D114C382462101 = 899
17634 - 410600097EC1D1D5 = 821
17642 - C5E5FE02F5284DFE = 1298
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17882 - 201821114141047E = 366
17890 - CB0F10FC3809CD82 = 886
17898 - 40E601FE0128033E = 655
17906 - 04C93E00CD0046D5 = 755
17914 - 14CD0046D1C947D5 = 989
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17930 - 0AFE0D2806FE8D28 = 758
17938 - 0278C93E04C9C5FE = 1041
17946 - 02D22746CD8240E6 = 950
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(continued on next page)

(continued from previous page)

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17970 - D57CFE03E5280DFE = 1130
17978 - 01280EFE00280FCD = 569
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18498 - 0B49211441CB48C2 = 689
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18578 - 1D41D17EFE80230A = 861
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18618 - [illegible] = 417
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19298 - 294B211541093600 = 298
19306 - 210941093600C329 = 408
19314 - 4B = 75
```


University Software

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MULTIVARIATE REGRESSION: Main output consists of estimated coefficients, t-stats, standard errors, R^2, corrected R^2, standard error of regression, F stat, and Durbin-Watson stat. Further output options: multiple correlation matrix, var-covar matrix, ANOVA of regression, residuals, plot of residuals, interpolation. Data options: Log/ln option for each variable, no-constant regression, choice of dependent variable, selection of independent variables, auto-omission of linearly dependent variables.

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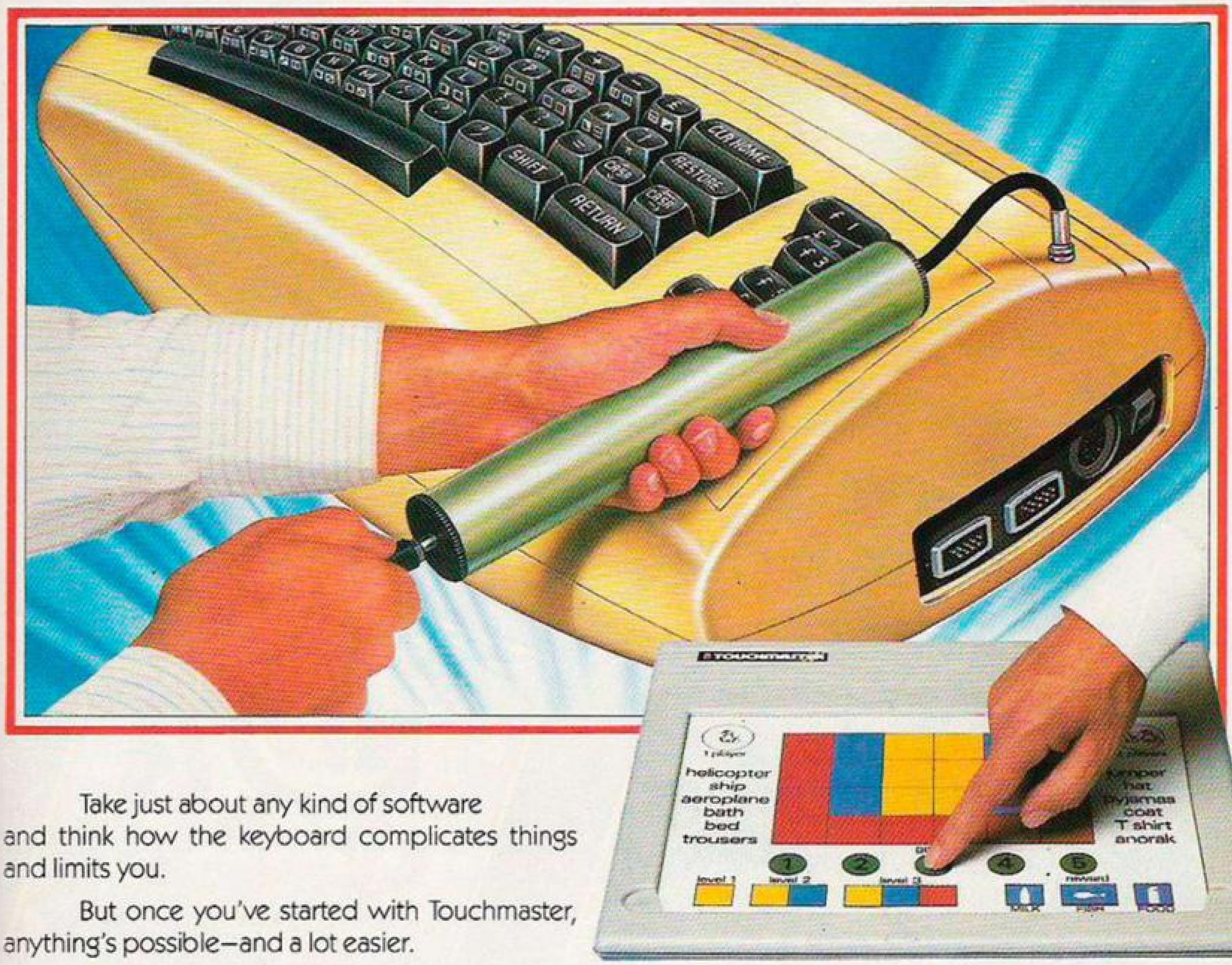

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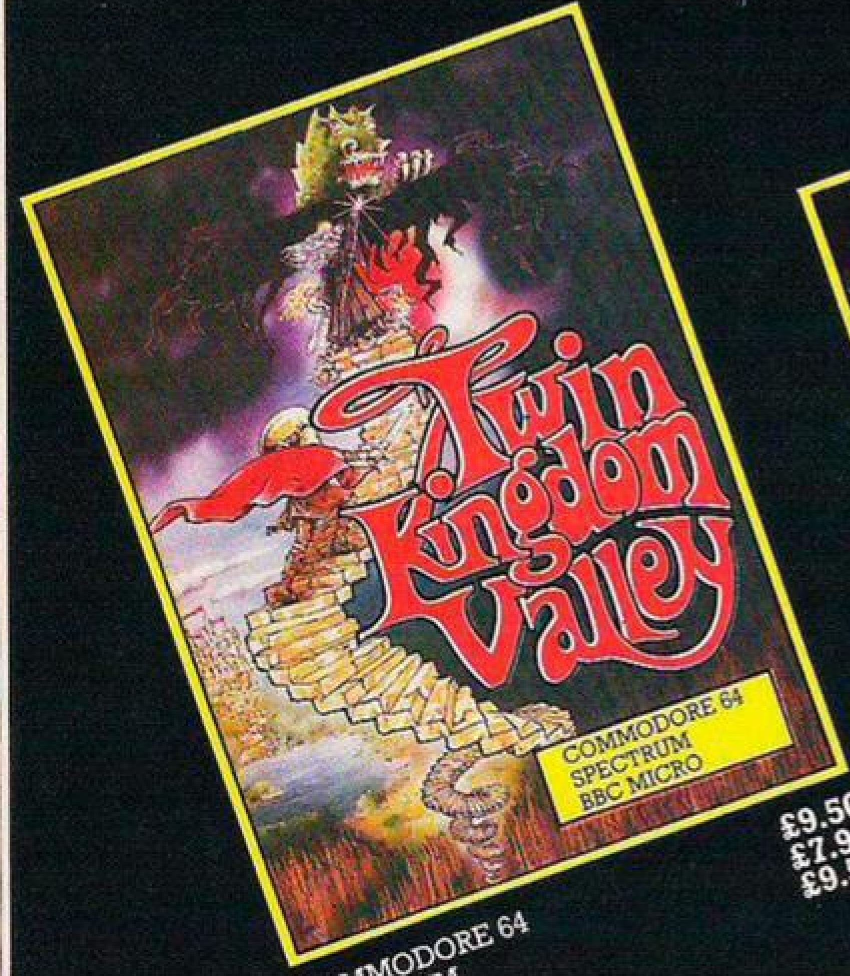

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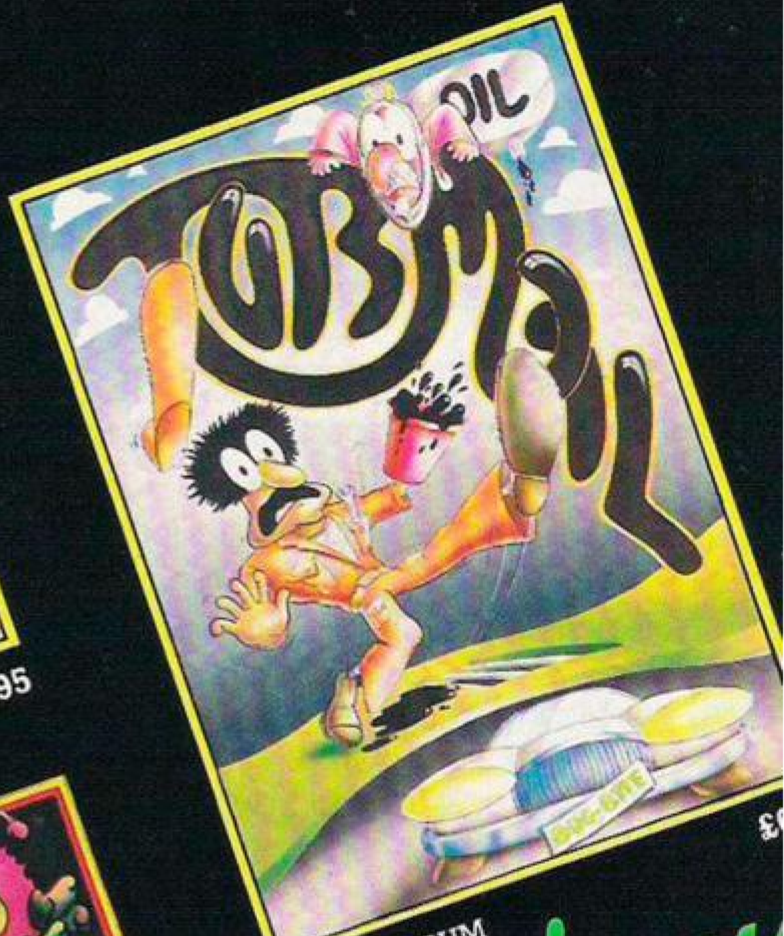

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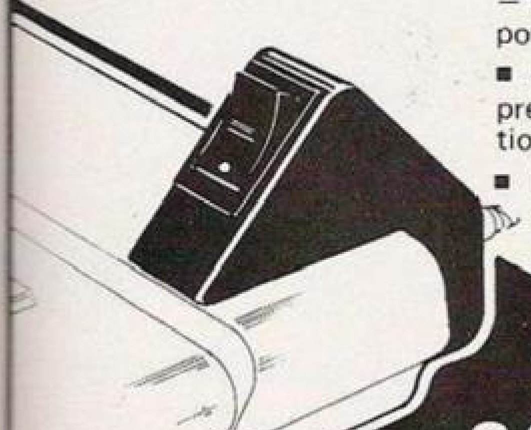

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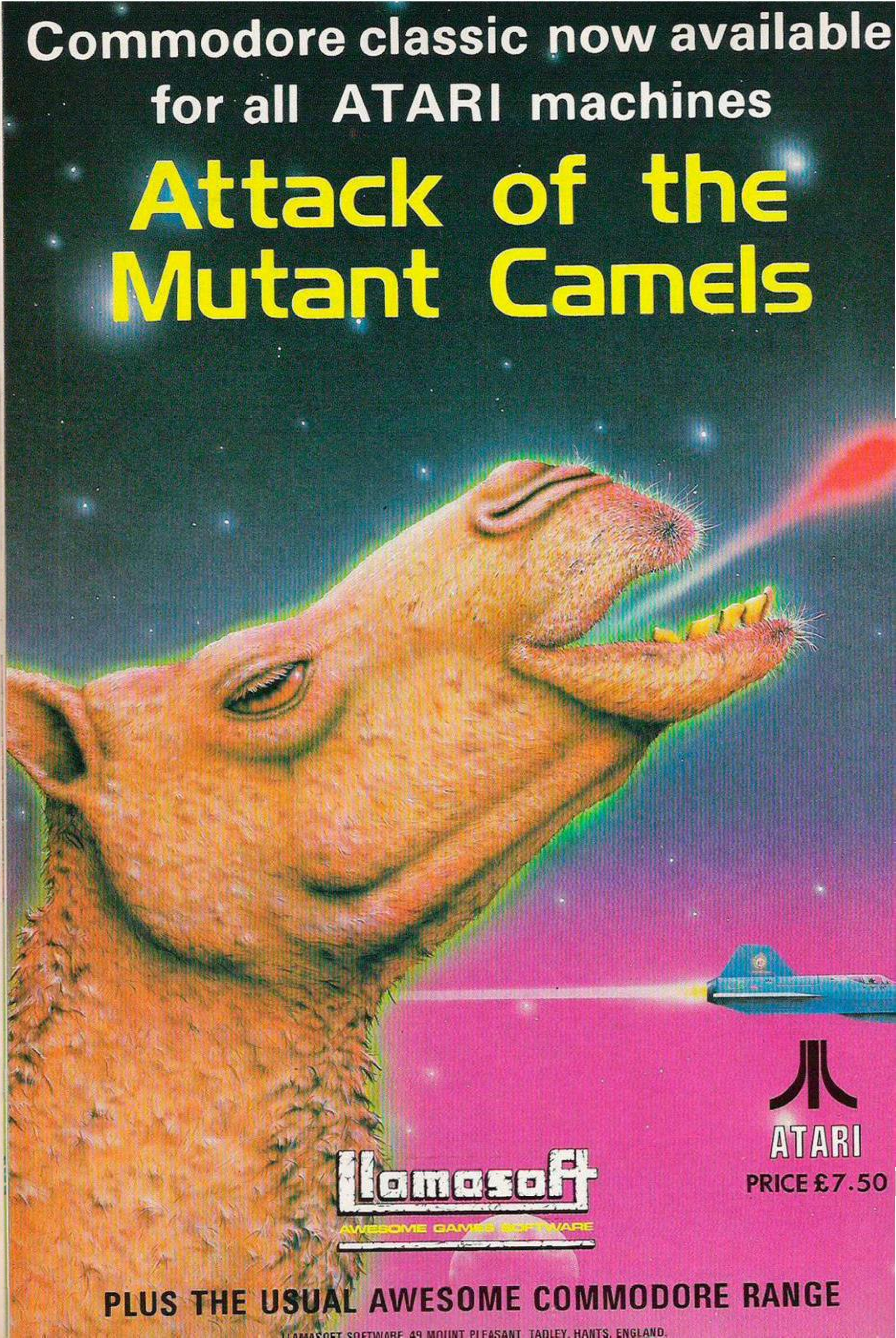
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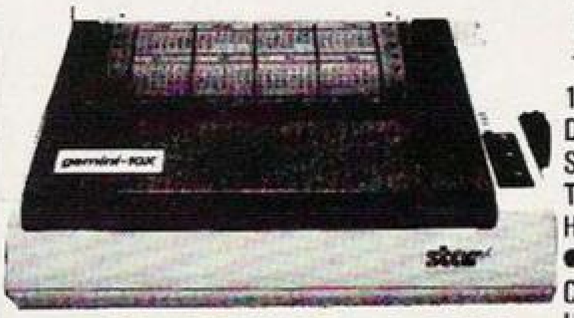

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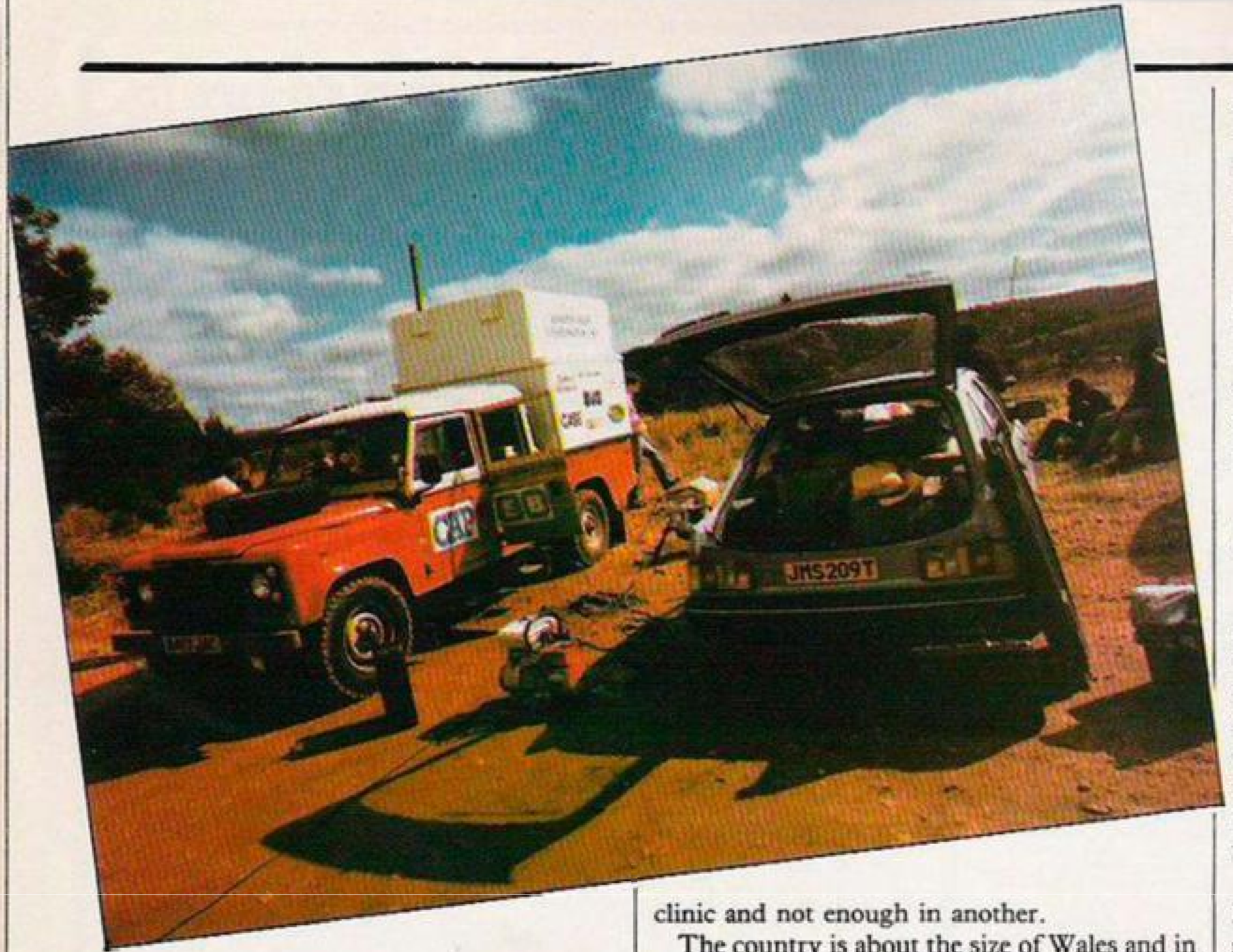


SWAZILAND WAS HIT by a cyclone about six months ago. Floods destroyed many of the country's bridges and washed away sections of the rail network. Houses were levelled and the telephone system was widely disrupted. With foreign aid Swaziland has recovered but the incident emphasised the importance of management and communications in dealing with natural disasters.

It was difficult to know in the aftermath of the cyclone where equipment was situated, what the current stock levels were at remote clinics, how much stock had been damaged, how many people had been injured and the nature of their injuries.

Apart from disaster relief, Swaziland has many health care and agricultural problems. Tuberculosis is still a common disease. Organised attempts are being made to identify and treat people with TB using modern anti-tuberculosis drugs such as Rifampicin.

Sent to the capital

If a case is suspected when someone is seen at a rural clinic or a district hospital they are sent to the capital for confirmation of the diagnosis. Treatment is started at the central hospital and the patient returns to the community. He or she will need a regular supply of Rifampicin for about two years.

It is in the nature of things that people move, complete their treatment, change their names, die from one or another cause and generally do all the things that complicate the lives of planners and managers.

On the one hand the Health Service administration aims to deliver supplies of the drug to the dispersed rural clinics so that nobody should have to walk more than five kilometres to collect their monthly supply. On the other, it is clearly important in any country, let alone Swaziland which is just emerging from being very poor, that expensive drugs like Rifampicin are not wasted because they are allowed to go out of date or because there is too much in one clinic and not enough in another.

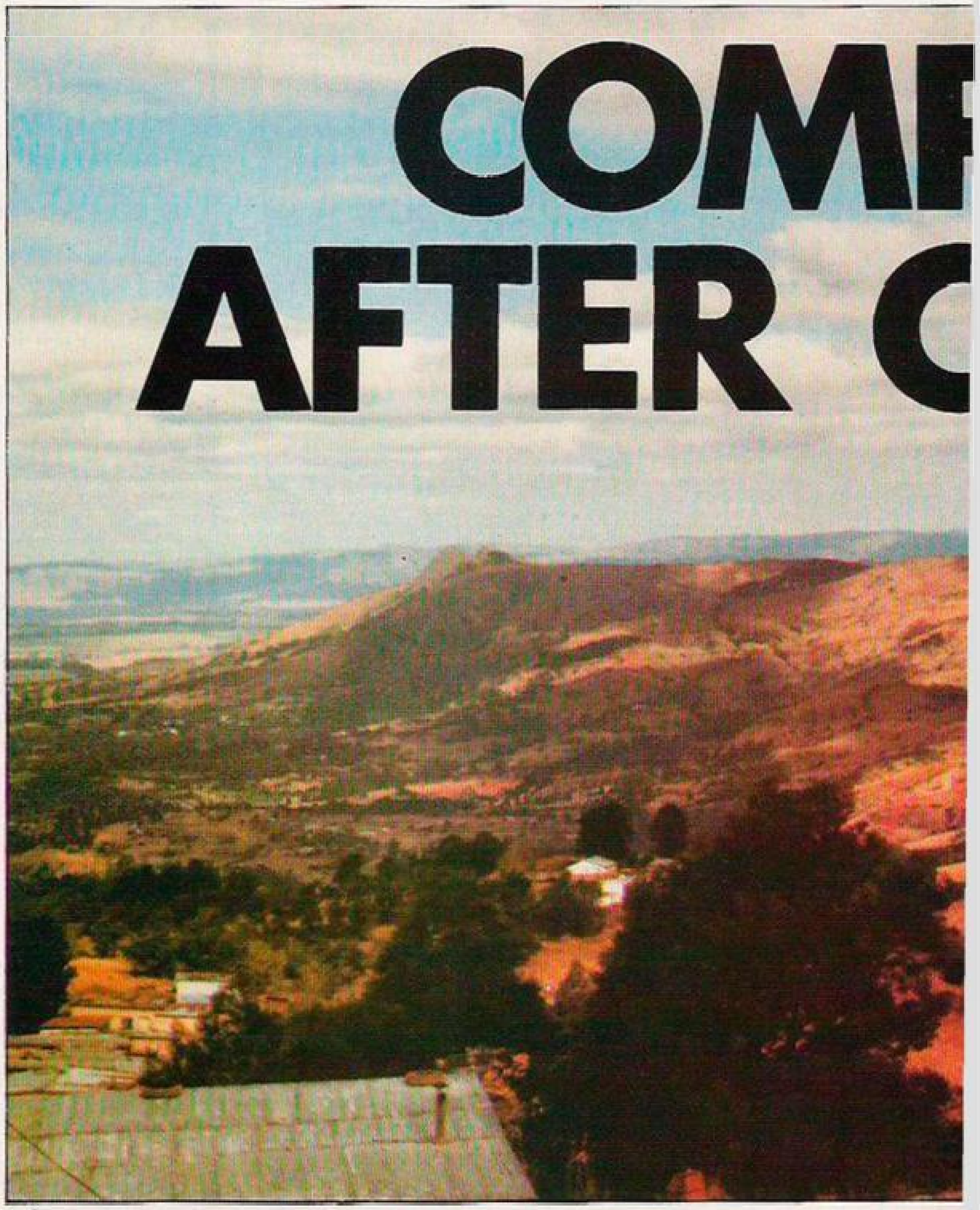
The country is about the size of Wales and in computing terms I have heard it described as about equivalent to a medium-sized company such as Boots the Chemists. Systems analysis is about defining the limits of one or more tasks — a system — and then investigating the input to the system, the manipulation of data that is required and the outputs that will provide the right answers at the right time for the users.

A stock control system might allow more efficient ordering and rotation of drugs. In Swaziland, nurses act as primary care workers, diagnosing and treating common illnesses, stitching wounds, carrying out vaccinations and child development surveillance, and dispensing medicines and contraceptives.

Supported by specialists

These skills can be supported by specialist physicians and surgeons working in district and central hospitals. In a country where skilled health care staff are few and far between it is arguable, for both disaster relief and ordinary health care, that communications systems may be a better investment, at least in the short term, than just trying to increase the numbers of doctors working in the country.

Alan Williams of Computer Analysts and Programmers U.K. Ltd (CAP) is a keen sailor and he had an idea that it should be possible to use maritime satellite communications techniques to improve communications between different parts of countries where the terrain



prohibits normal telephone or short wave radio links.

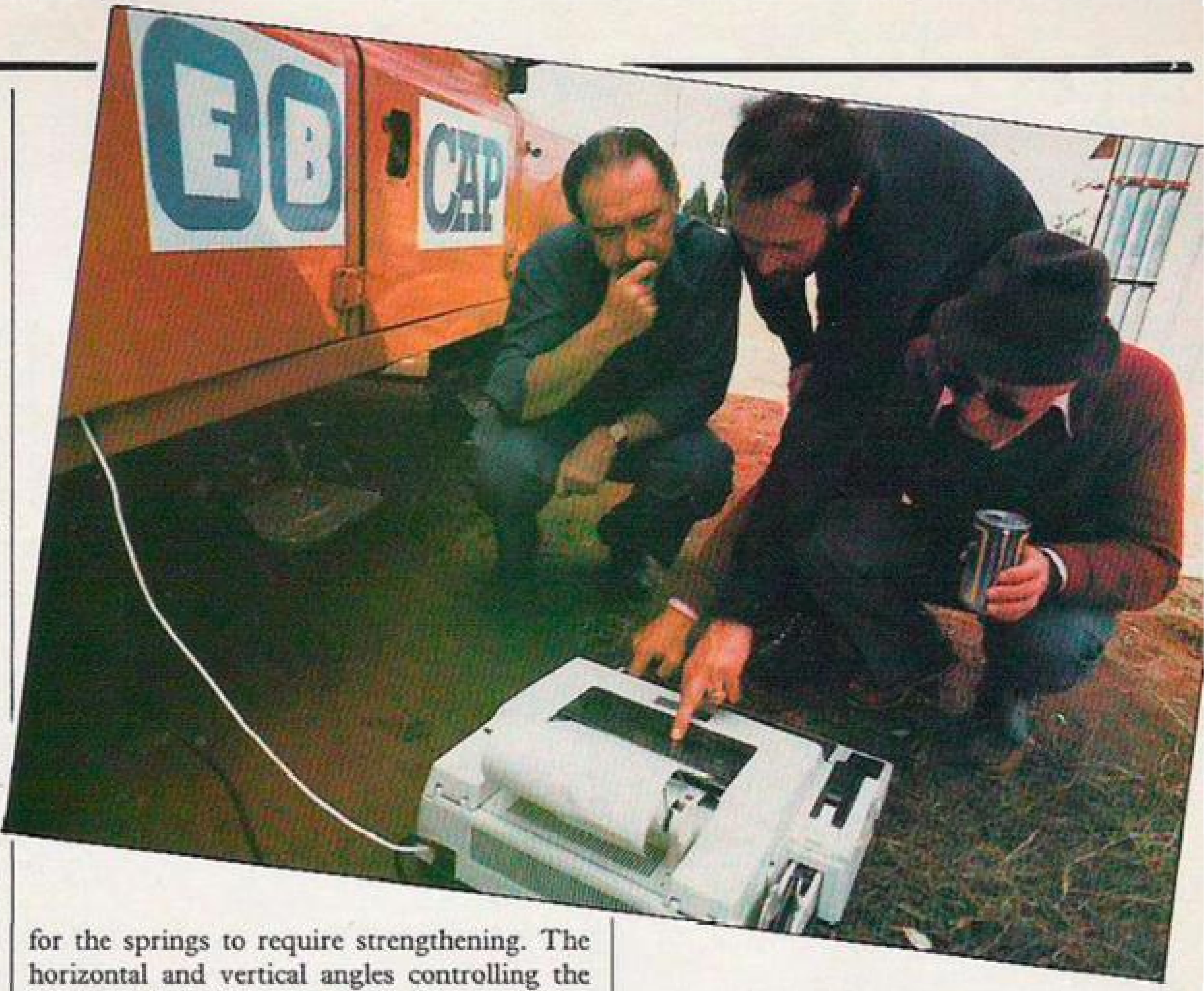
The links should be either internal to the country, joining remote sites to a focal point, probably in the capital; or external, joining sites in the country to remote databases and experts in other countries.

Additionally, a mobile satellite communications terminal could be driven to the site of a major disaster, or could be airlifted and dropped in to provide voice and data links so that supplies can be directed to the right place in the right quantities, reducing waste and increasing the rescue agencies speed of response.

DoI financed pilot study

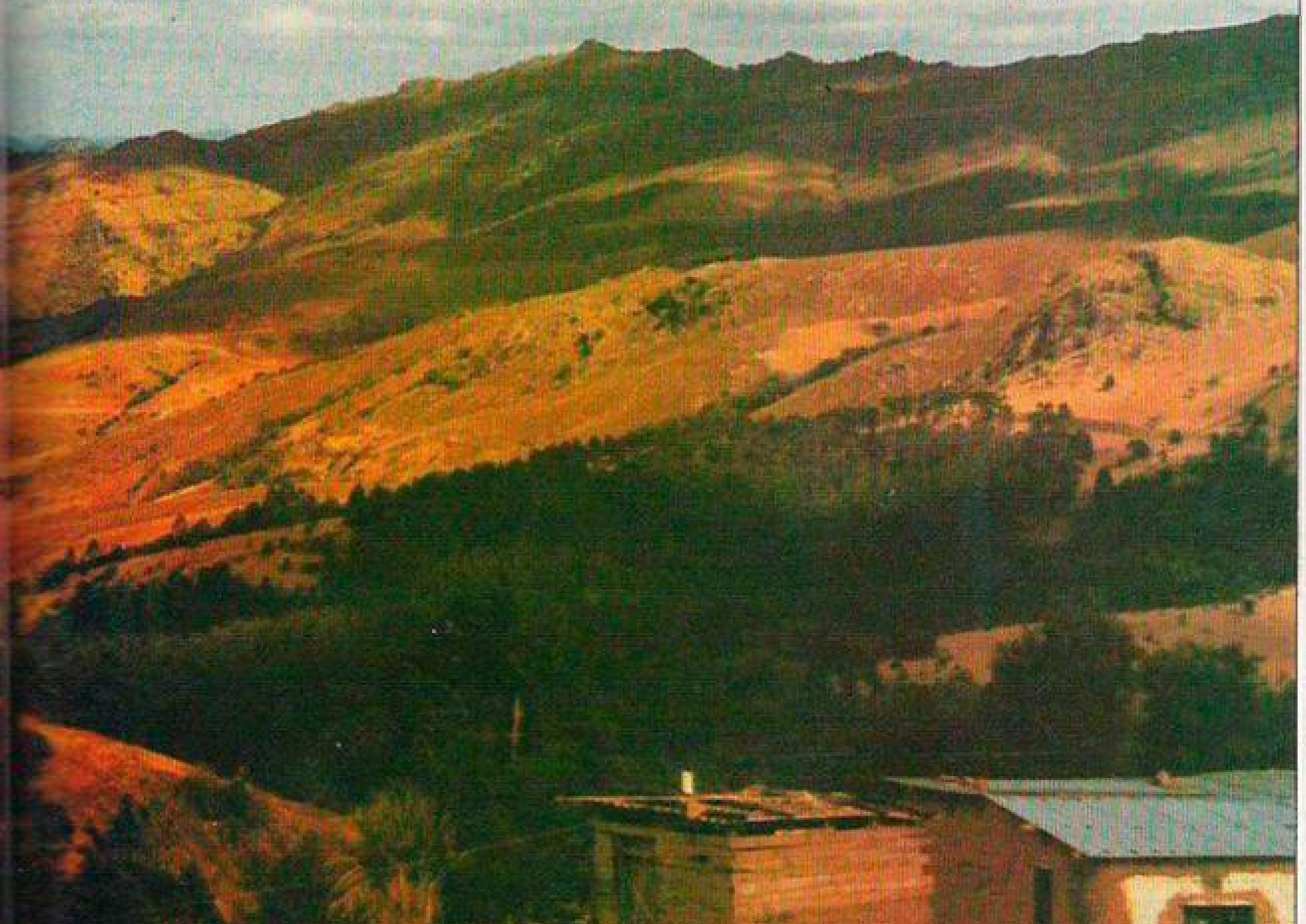
The Department of Industry financed a pilot study into the feasibility of CAP's project. A Land Rover was equipped with a Saturn ship earth station — SES —, a 10 Megabyte hard disc computer with an ordinary dot matrix printer, a video camera and a digitiser to convert each picture into digital numbers that could be transmitted down a standard 75/1200 or 300/300 baud modem, and last, but wholly essential, a British Telecom telephone.

Mounted on the back of the Land Rover, the dish aerial and its mounting weighed enough for the springs to require strengthening. The horizontal and vertical angles controlling the direction in which the dish faces were set manually using a cheap dashboard-mounted compass and the final alignment was done



UTING YCLONES

John Dawson describes how computers help in the aftermath of disasters.



using the received signal strength readings from the satellite terminal. Bearings and azimuth readings were checked as Inmarsat dictates using a teleprinter terminal.

Inmarsat is an organisation that owns and operates a number of geostationary satellites used principally for marine navigation and communications. The satellites that we were using hang over the South Atlantic and Indian Oceans about 22,000 miles above the Earth's surface. The conditions under which Inmarsat operates permits the use of the satellites by land-based stations for humanitarian purposes.

Sharper than a ship

The motion of the Land Rover over rough surfaces is much sharper than a ship and the servo mechanisms holding the dish aerial on a steady bearing couldn't control the sudden accelerations. Power consumption in the test vehicle was probably higher than would be necessary in a production model.

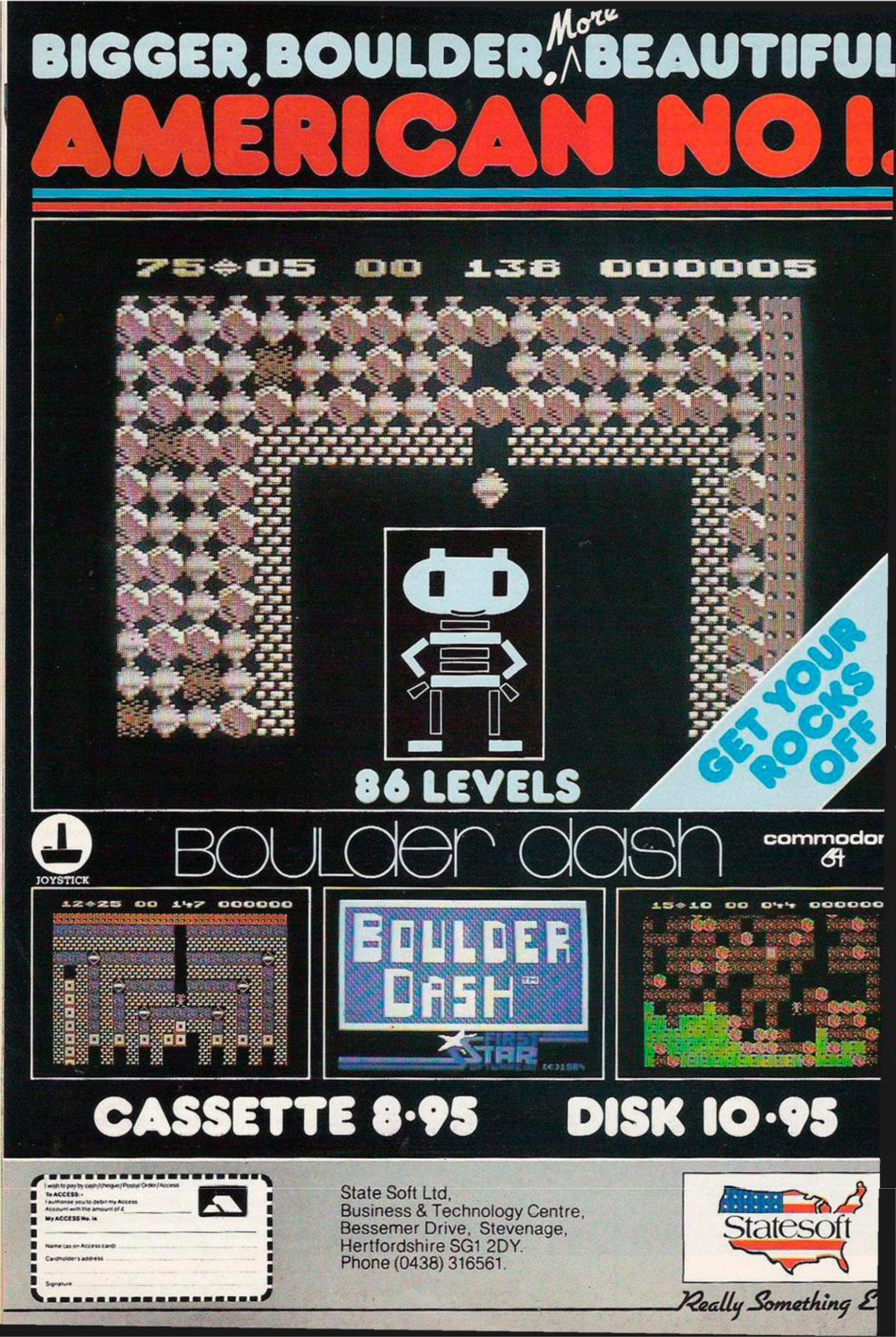
CAP used a standard petrol-driven 230 volt 13 amp generator to run the satellite tracking electronics, the microcomputer and all the peripheral devices. Consequently, for both these reasons, the vehicle had to be stationary to receive or make calls.

Using the telephone we dialled through the satellite to one of the Packet Switch Stream — PSS — computers in the U.K. The PSS network is operated by British Telecom and provides a cheap and efficient method of exchanging information between computers.

A number of computers are scattered around the United Kingdom in the main population centres such as London, Birmingham, Leeds, Cambridge and so on. You can obtain a Network User Identity or NUI from the Post Office and can then access the PAD — Packet Assembler/Disassembler.

After entering your NUI you are asked for the address of the computer you wish to contact. The remote computer may be in the U.K.

(continued on page 167)



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Really Something

(continued from page 165)

or it may be located just about anywhere else in the world. At first I was puzzled by a delay of about half a second before characters appeared on the computer screen but then I realised that it was simply the distance that was responsible — 22,000 miles up to the satellite, the same down to the Goonhilly earth station in Cornwall, to London, and then the return journey — about 88,000 miles in all, just under half a second at the speed of light in a vacuum.

From London it was easy to get into Data Mail in Switzerland and Colleague at Latham, close to New York. Information retrieval and communications in the Swazi uplands seemed to have been revolutionised overnight.

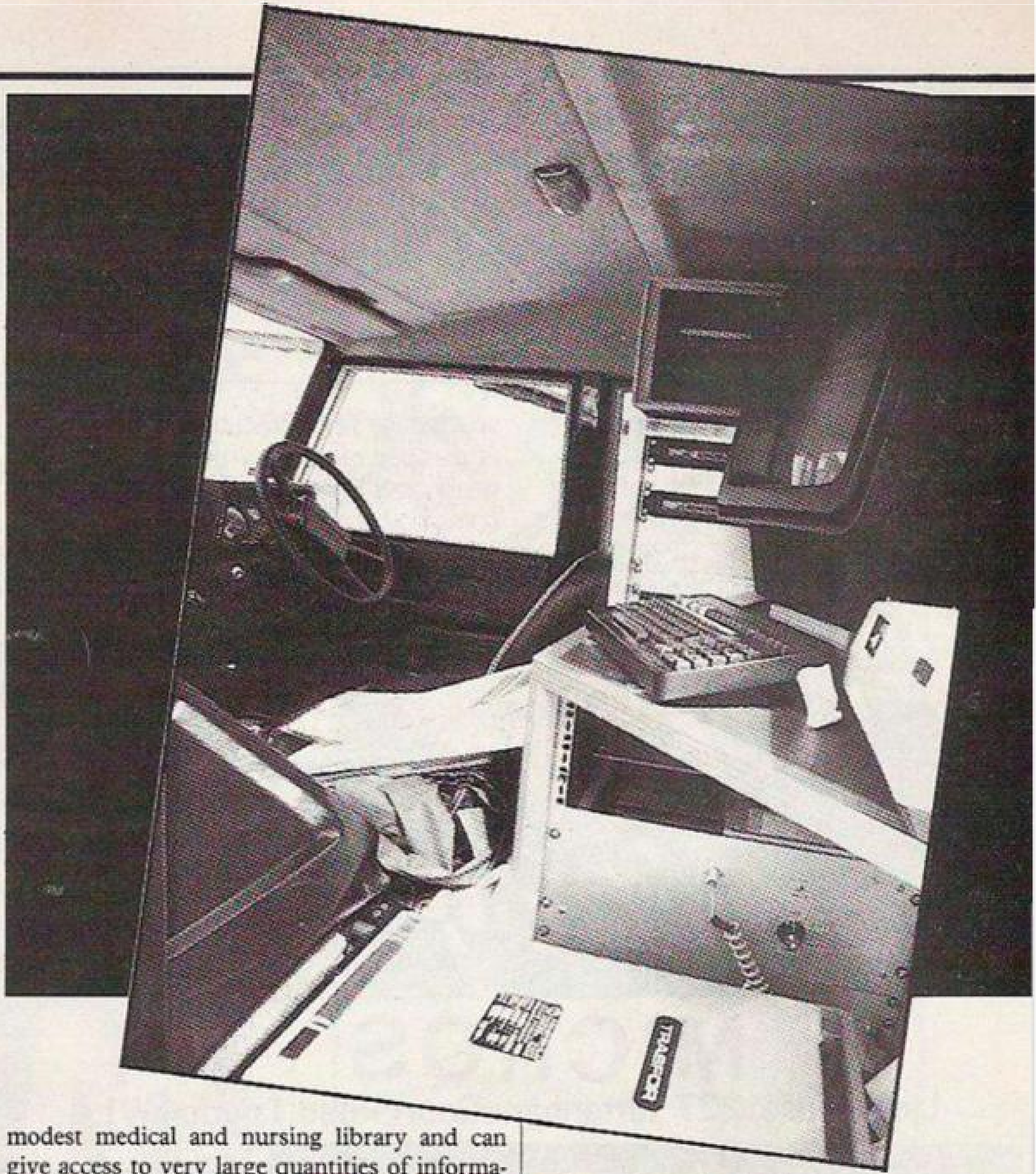
But was that really true? Certainly the equipment performed without fault despite the rough terrain over which it was carried. We learned that you need two channels open simultaneously for a sensible debate of medical problems, data can be exchanged on the first and the second must be a voice link so that the data can be discussed as it is presented.

Scope for development

Many ideas sprang out of the pilot study, for example there seems to be scope for the development of culture specific icons to help people with no previous training to use computers more easily. We give drugs according to the time of day in the United Kingdom but in a country where clocks are quite rare it makes very good sense to use pictures or ideograms of a rising sun, a midday sun, a setting sun and the moon to set the time at which doses must be given.

Conversely, I have thought for some time that selling inappropriate high technology to developing countries should be a serious crime. Nothing drains resources more quickly than the running costs and training requirements of a complex piece of high-tech equipment. While I have no doubt that computers and other equipment can benefit developing countries — that is only true provided they are used in the right way.

It's correct, for example, that a satellite communications terminal can cost less than a modest medical and nursing library and can give access to very large quantities of information. The Colleague searching software can track down material in a fraction of a second that a skilled human librarian might take hours to find. Keeping an electronic library up to date is comparatively easy and need not concern the remote user at all.



But the content of Northern hemisphere databases is aimed almost exclusively at Northern hemisphere users. That is not surprising for the object of a database owner is to collect together information that may be profitably distributed.

Information that reflects the needs of doctors scientists and other professionals and techno logists in the Northern hemisphere may well b wholly inappropriate for health care workers engineers, managers and agriculturalist working in developing Southern hemispher countries.

The information that I obtained from Col league's American textbooks of neurosurger was interesting but not particularly relevant t the immediate needs that we encountered. Th technological aspects of medicine, as oppose to medical science, are all important in isolate communities and developing countries.

We have more than enough knowledge to pu right much of the world's ill health; what i lacking is the management and practica application of that knowledge. The con struction of practical, technologically oriente databases offering relevant information seem to be one of the keys to the success of th information revolution in the third world.

The management and scientific problem facing Swaziland exist in varying degree throughout the developing countries. A straight transfer of developed country scienc and technology is likely to be an unsatisfactor and superficial answer.

The sensitive development of relevant data bases and the application of the best and mos appropriate technology might allow Swazilan and other third world countries to escape som of the pitfalls we keep encountering.

Of course, the application of the same tech niques with the same management skill migh be expected to have a similar effect in other more developed countries as well. ■

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DIS/ASSEMBLER MONITOR

Martin Lightfoot expands the programming potential of your CBM-64.

CBM 64

THIS PROGRAM is a complete machine-code programming tool for the Commodore 64. It contains a machine-code monitor which allows the easy manipulation of memory, a disassembler which translates machine-code programs into the more comprehensible assembley language format, and an editor/assembler which together allow assembly language programs to be developed and translated into machine code.

Monitor: Anybody who owns or used to own a Commodore Pet should recognise the style of this machine-code monitor as it is based on the TIM monitor which used to come as standard on the Pet but was dropped on the Vic-20 and CBM-64. It provides the user with the following seven commands:

M XXXX YYYY — displays on the screen the contents of memory between the given hex addresses.
F XXXX YYYY ZZ — fills memory between the given hex addresses with the hex byte 22.
T XXXX YYYY ZZZZ — moves memory between the hex addresses XXXX and YYYY to new address starting at ZZZZ.
G XXXX — executes a machine-code program starting at XXXX hex.
X — return to menu.
L or L"prog name" — loads previously saved machine-code program back into memory at address from where it was saved.'
S"prog name" XXXX YYYY — saves memory between given hex addresses to tape.
Note — if no program name is required in the Save command, then the quotation marks must still be present, but left empty.

All numbers must be in hex and of the length shown. Spaces must be inserted between all hex numbers and command letters, except between the S or L command and the quotation marks. A space must be inserted after the second quotation mark in an S command before the start address of the save.

To edit the memory, just list the memory to the screen using the M command as previously described. Then move the cursor up to the required position on the screen and edit the data.

Note that all numbers must be in hex and two digits long, i.e., leading zeros may have to be added. When you have finished editing the memory pressing Return will Poke the new data into memory.

When displaying memory on screen using the M command, the Return key can be pressed to return to command mode.

All errors or mistakes in the syntax of commands will be indicated by a question mark at the beginning of the offending line.

Disassembler: The disassembler, option three on the menu, is capable of providing assembly language translations of machine-code programs in memory in the standard format.

To use the disassembler, you are required to input a start address. This can be in either decimal or hexadecimal, in which case a dollar sign must precede the hex number.

Disassemble to printer

You are given the option of disassembling to the screen or printer. To disassemble to the printer, you must type Y to the question output to printer? To disassemble to the screen, you simply press Return.

After every 20 machine-code instructions disassembled, you have to press Space to disassemble the next 20 instructions, or any other key to return to the menu.

The disassembler can be used to plough through the 64's Rom or it can be used to disassemble code that you have already written.

The occurrence of ??? indicators means that you are attempting to disassemble an area of memory that does not contain a machine-code program, or you have chosen a start address that is not the first byte of a machine-code instruction.

If the latter is the case, then the disassembler will eventually synchronise itself within the program in memory.

Editor: The editor is simply a means of entering your assembly language programs into the computer.

The editor works by changing the Basic pointers to point to a free area of memory, then you enter your assembly language program as you would a Basic program. This means you give each instruction a line number — only one instruction per line — and you insert and delete lines in the normal way. You can also Load and Save programs to tape or disc using the normal Basic commands. To get a listing of the program on printer use:

OPEN4,4:CMD4: LIST then after printing

(continued on next page)

```
10000 POKE55,0:POKE56,100:CLR:POKE808,237
10004 FORI=0TO13:POKE740+I,PEEK(43+I):NEXT
10005 OPEN1,0:DIM NB(13),SY$(30),SY(30),ER$(13),BK$(74)
10010 T1$="-E   EX GEX  EX .E   EX 0E   EX ?$  )$J I$J )$J #$   $J O$   $J "
10020 T1$=T1$+"L    :C F:C >:C .:   :C 2:   :C M0   0K H0K )0K /0   0K G0   0K "
10030 T1$=T1$+" R  TRS 9 X TRS &R  TRS ZRY  R  B0A B0A V0U B0A '0  B0A 30W B0A "
10040 T1$=T1$+"64  647 =48 647 +4   47 14   47 5N  5N: CND 5N: (N   N: PN   N:"
10050 T2$="8:   22 810  55 9;   33 87   66 5:  222 010 555 9;   33 87   66 "
10060 T2$=T2$+"8:   22 810 555 9;   33 87   66 8:   22 810 C55 9;   33 87   65 "
10070 T2$=T2$+" :  222 8 8 555 9;  334 878  6  1:1 222 810 555 9;  334 878 667 "
10080 T2$=T2$+"1:  222 810 555 9;   33 87   66 1:  222 810 555 9;   33 87   66"
10090 T3$="ADCANDASLBCCBCSBEQBITBMIBNEBPLBRKBVCBVSCLCCLDCLICLVCMPCPXCPYDECDEXDEY
10100 T3$=T3$+"EORINCINXINYJMPJSRLDALDXLDYLSRNOPORAPHAPHPPLAPLPROLRORRTIRTSSBC
10110 T3$=T3$+"SECSEDSEISTASTXSTYTAXTAYTSXTXATXSTYA
10120 HT$="0123456789ABCDEF"
10130 DEFFNDEC(X)=X-48+(X>57)*7
10140 FORI=1TO13:READNB(I):NEXTI
10150 DATA 0,1,1,1,1,2,2,2,0,1,1,1,2
10160 FORI=1TO56:READA:T4$=T4$+CHR$(A):NEXT
10170 DATA 8,8,5,1,1,1,2,1,1,1,1,1,1,1,1,1,1,0,3,3,4,1,1,8,4,1,1,2,1,0,5,5,5,1
10180 DATA 8,1,1,1,1,5,5,1,1,8,1,1,1,7,3,3,1,1,1,1,1,1
10190 FORI=1TO56:READA:T5$=T5$+CHR$(A):NEXT
10192 DATA 97,33,6,144,176,240,36,48,208,16,0,80,112,24,216,88,184,193,224,192
10194 DATA 198,202,136,65,230,232,200,76,32,161,162,160,70,234,1,72,8,104,40
10196 DATA 38,102,64,96,225,56,248,120,129,134,132,170,168,186,138,154,152
10200 FORI=0TO74:READBK$(I):NEXT
10205 DATA END,FOR,NEXT,DATA,INPUT#,INPUT,DIM,READ,LET,GOTO,RUN,IF,RESTORE,GOSUB
10210 DATA RETURN,REM,STOP,ON,WAIT,LOAD,SAVE,VERIFY,DEF,POKE,PRINT#,PRINT,CONT
10215 DATA LIST,CLR,CMD,SYS,OPEN,CLOSE,GET,NEW,TAB(,TO,FN,SPC(,THEN,NOT
10220 DATA STEP,+,-,*,/,↑,AND,OR,>,=,<,SGN,INT,ABS,USR,FRE,POS,SQR,RND,LOG,EXP
10225 DATA COS,SIN,TAN,ATN,PEEK,LEN,STR$,VAL,ASC,CHR$,LEFT$,RIGHT$,MID$
10230 IFPEEK(736)=167THEN10400
10240 FORI=755TO761:READA:POKEI,A:NEXT
10250 DATA 83,89,83,55,48,48,13
10260 FORI=25610TO25638:READA:POKEI,A:NEXT
10270 DATA 160,0,165,2,145,251,230,251,208,2,230,252,165,251,197
10280 DATA 253,208,240,165,252,197,254,208,234,165,2,145,253,96
10290 FORI=25639TO25671:READA:POKEI,A:NEXT
10300 DATA 160,0,177,251,145,253,230,251,208,2,230,252,230,253,208,2
10310 DATA 230,254,165,251,205,52,3,208,233,165,252,205,53,3,208,226,96
10320 FORI=25672TO25716:READA:POKEI,A:NEXT
10330 DATA 169,32,162,1,160,1,32,186,255,165,2,162,167,160,2,32,189,255,96
10340 DATA 32,72,100,166,253,164,254,169,251,32,216,255,96
10350 DATA 32,72,100,169,0,162,255,160,255,32,213,255,96
10352 FORI=25717TO25755:READA:POKEI,A:NEXT
10354 DATA 165,197,201,4,208,17,162,0,189,243,2,157,119,2,232,224,7,208
10356 DATA 245,169,7,133,198,76,49,234,120,169,117,141,20,3
10358 DATA 169,100,141,21,3,88,96
10360 FORI=700TO736:READA:POKEI,A:NEXT
10370 DATA 165,46,201,100,144,22,165,45,141,200,100,165,46,141,201,100
10380 DATA 162,0,189,228,2,149,43,232,224,14,208,246
10390 DATA 32,94,166,32,142,166,76,174,167
10395 POKE25800,3:POKE25801,101:POKE25856,0:POKE25857,0:POKE25858,0
10396 :
```

```
10400 REM *** ASSEMBLER ERROR MESSAGES ***
10410 ER$(0)="ADDRESSING MODE
      NOT AVAILABLE WITH THISMNEMONIC"
10415 ER$(1)="INVALID HEX NUMBER"
10420 ER$(2)="OUT OF LABEL SPACE"
10430 ER$(3)="LABEL NOT ALPHA-NUMERIC"
10440 ER$(4)="NO SUCH MNEMONIC"
10450 ER$(5)="UNDEFINED LABEL"
10460 ER$(6)="BRANCH OUT OF RANGE"
10470 ER$(7)="SINGLE BYTE OUT OF RANGE"
10475 ER$(8)="LABEL MORE THAN 6 CHARS"
10480 ER$(9)="LABEL DEFINED TWICE"
10485 ER$(10)="SYNTAX"
10490 ER$(11)="NO ASSEMBLY LANGUAGE PROGRAM"
10495 ER$(12)="ILLEGAL QUANTITY"
10496 ER$(13)="DIVISION BY ZERO"
10499 :
10500 POKE53280,0:POKE53281,0:PRINTCHR$(14)CHR$(8):
      NA=25857:DV=1:FR=FRE(0)
10510 PRINT"   "TAB(12)"MENU OF OPTIONS"
      :PRINTTAB(12)"=================="
10520 PRINT"  "TAB(8)"1)....MONITOR"
10530 PRINT" "TAB(10)"2)....ASSEMBLER"
10540 PRINT" "TAB(12)"3)....DISASSEMBLER"
10550 PRINT" "TAB(14)"4)....PROGRAM EDITOR"
10560 PRINT"   "TAB(5)"PRESS KEY 1 - 4 TO CONTINUE..."
10570 POKE198,0
10580 GETIN$:IFIN$<"1"ORIN$>"4"THEN10580
10590 PRINTCHR$(147)
10600 ONVAL(IN$)GOTO13000,20000,11800,15000
10610 :
11000 REM *** CONVERT DECIMAL TO HEX ***
11010 H$=""
11020 HI=INT(H/256):LO=H-HI*256:IFHI=0ANDFL=0THEN11050
11030 A=HI/16:HI=HI-INT(A)*16
11040 H$=H$+MID$(HT$,A+1,1)+MID$(HT$,HI+1,1)
11050 A=LO/16:LO=LO-INT(A)*16
11060 H$=H$+MID$(HT$,A+1,1)+MID$(HT$,LO+1,1)
11070 RETURN
11080 :
11100 REM *** CONVERT HEX TO DECIMAL ***
11110 H=0:ER=0
11120 FORI=1TOLEN(H$):HH=FNDEC
      (ASC(MID$(H$,I,1))):H=H*16+HH
11130 IFHH>15ORHH<0THENER=1
11140 NEXT
11150 IFH>65535THENER=1
11160 RETURN
11170 :
11799 REM *** DISASSEMBLER ***
11800 REM *** INPUT START ADDRESS ***
11810 INPUT"  START ADDRESS";AD$
11820 IFAD$=""THEN11810
11830 IFLEFT$(AD$,1)="$"THEN11860
11840 AD=VAL(AD$):IFAD<1ORAD>65535THEN11810
11850 GOTO11900 :
11860 H$=RIGHT$(AD$,LEN(AD$)-1)
11870 GOSUB11100
11880 IFER=1THENER=0:GOTO11810
11890 AD=H
11900 INPUT"OUTPUT TO PRINTER      ";FL$
11910 IFFL$<>"N"ANDFL$<>"Y"THENPRINT"  ":GOTO11900
11920 IFFL$="Y"THENOPEN4,4:PR=1
12000 PRINT" ":FORI=1TO20:PE=PEEK(AD):
      IFPE=255THENAM=9:MN$="???":GOTO12040
12005 FR=FRE(0)
12010 P1=ASC(MID$(T1$,PE+1,1))-34:
      IFP1<0THENAM=9:MN$="???":GOTO12040
12020 MN$=MID$(T3$,P1*3-2,3)
12030 AM=ASC(MID$(T2$,PE+1,1))-47
12040 H=PE:GOSUB11000
12050 BY$=H$+" "
12060 IFNB(AM)=0THENBY$=BY$+"      ":GOTO12200
12070 IFNB(AM)=2THEN12170
12080 H=PEEK(AD+1):GOSUB11000
12090 BY$=BY$+H$+"   "
12100 IFAM=10THEN12120
12110 GOTO12190
12120 H1=PEEK(AD+1)
12130 IFH1<128THENH=AD+H1+2:GOTO12150
12140 H=AD-(256-H1)+2
12150 GOSUB11000
12160 GOTO12190
12170 FL=1:H=PEEK(AD+1)+256*PEEK(AD+2):GOSUB11000:FL=0
12180 BY$=BY$+RIGHT$(H$,2)+" "+LEFT$(H$,2)
12190 H$="$"+H$
12200 ONAMGOTO12500,12550,12600,12650,12700,12600,
      12650,12700,12220,12600,12750
12210 ON14-AMGOTO12850,12800
12220 FL=1:H=AD:GOSUB11000:FL=0
12230 PRINT" "H$SPC(3)" "BY$"    "MN$
12240 IFPR=1THENPRINT#4,H$SPC(5)BY$"    "MN$
12250 AD=AD+NB(AM)+1
12260 IFAD>65535THENFL=1:I=20
12270 NEXTI
12280 PRINT"  PRESS   SPACE   TO CONTINUE
      . . .":POKE198,0:FR=FRE(0)
12290 GETIN$:IFIN$=""THEN12290
12300 IFIN$<>" "THEN12320
12310 IFFL=0THEN12000
12320 FL=0:PR=0:CLOSE4:GOTO10500
12490 :
12500 REM *** ACCUMULATOR ***
12510 MN$=MN$+" A"
12520 GOTO12220
```

(listing continued on page 17

(continued from previous page)

PRINT # 4:CLOSE4

When you have entered your program you simply press f1 which, by using an interrupt, returns you to the menu by resetting the basic pointers to point to the assembler program which automatically Runs.

If, while typing in your assembly language program, you press Run/Stop and Restore simultaneously, the interrupt will be turned off, and pressing f1 will not return you to the menu. If this is the case then you will have to type SYS700 to get back to the menu.

Make sure you type the Sys call correctly as the program could crash resulting in you having to switch the machine off and on again to regain control.

The editor gives you 6909 bytes to enter your assembly language programs which should be more than enough for most programs. If you find this limiting, you will have to type your programs in more than one part i.e., assemble one part, enter the next part using the editor, and assemble this second part directly after the first.

Two pass assembler

Assembler: The assembler incorporated in this program is a full two pass assembler, which allows the use of labels, variables and comments to make the assembly language program more understandable. It accepts all the standard assembler mnemonics in their standard formats.

The use of Labels enables a program to be directed to a named instruction without the need to calculate branches or jump addresses. For example, the instruction

BNE LABEL1

instructs the assembler to branch to the instruction with label name Label1. Elsewhere in the program, there should be an instruction preceded with this label name. For example:

.LABEL1 LDA # $FF

When a label is defined, it must be preceded with a full stop to tell the assembler that it is a label and not an instruction. The label can be any alpha-numeric characters — letters and numbers — and up to a maximum length of six characters. It should always be separated from the instruction with a space. There must be no space between the full stop and the label name.

Comments can be added

Variables can be defined as in a Basic program, for example:

LABEL1 = 49152
LOOP1 = $FFFF
LABEL2 = LOOP1 − LABEL1
LOOP2 = LABEL1/256

The same rules apply to the variable name as those for the labels, except that no full stop is required. A total of 30 variables and labels are allowed in any one assembly language program. If you need more, then change the arrays SY$ and SY in line 10005, and the 30 in line 20310.

Comments can be added to the end of an assembly language instruction by separating them with a semi-colon. Anything that appears after the semi-colon will be totally ignored during assembly.

The assembler also provides a simple expression evaluator for the addition, subtraction, multiplication and division of two numbers, labels or variables. For example:

LDA LABEL + 256
LOOP = LABEL/4096
STA CONST * 10
TEMP = NEXT − FIRST
SYMBOL = $FFFF/256

The assembler provides six "directives" which do not appear in the machine-code program, but modify the manner of assem

- ORG [address] — this directive m appear at the beginning of every assen language program. It tells the assem where to place in memory the asseml machine-code program. More than ORG directive can appear in a si assembly language program if diffe sections of the program are to be pla in entirely different areas of memory.
- PRT — following this directive outpu the assembled program is diverted f the screen to the printer.
- SYM — this indicates that the syr table containing all the values of varia and labels used in the assembly langu program, are to be appended to the lis of the assembled program.
- END — when this directive encountered in a program, assemb terminated. It does not have to be the line in a program.
- BYT — this directive allows a serie one byte values to be specified in a s line. The values will be entered dir into memory when the prograr assembled. Both decimal and numbers are allowed, but hex nun must be preceded by a dollar sign.
- TXT — this directive allows a stri characters to be placed into memory characters must be enclosed v quotation marks after the TXT dire The ASCII values of each characte POKEd into memory.

The following areas of memory are av for your machine-code programs.

DECIMAL	HEX
679 → 767	($02A7) → 02FF)
32768 → 40960	(8000 → A000)
49152 → 53248	(6000 → D000)

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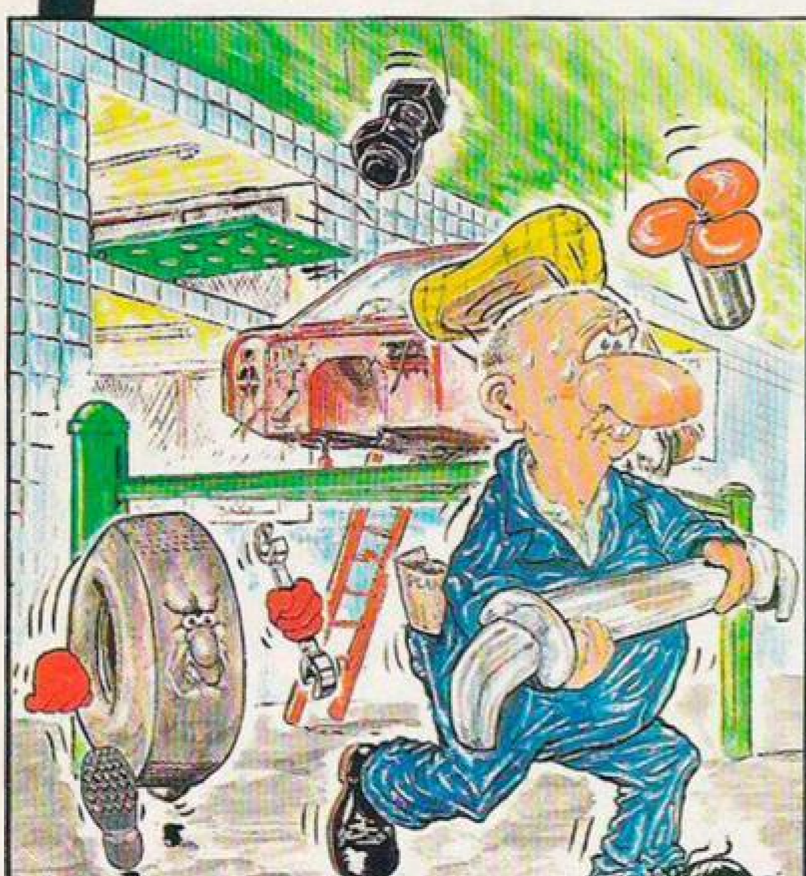

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(continued from page 170)

```
12550 REM *** IMMEDIATE ***
12560 MN$=MN$+" #"+H$
12570 GOTO12220
12600 REM *** ZERO PAGE/ABSOLUTE/RELATIVE ***
12610 MN$=MN$+" "+H$
12620 GOTO12220
12650 REM *** ZERO PAGE.X/ABSOLUTE.X ***
12660 MN$=MN$+" "+H$+",X"
12670 GOTO12220
12700 REM *** ZERO PAGE.Y/ABSOLUTE.Y ***
12710 MN$=MN$+" "+H$+",Y"
12720 GOTO12220
12750 REM *** (INDIRECT.X) ***
12760 MN$=MN$+" ("+H$+",X)"
12770 GOTO12220
12800 REM *** (INDIRECT),Y ***
12810 MN$=MN$+" ("+H$+"),Y"
12820 GOTO12220
12850 REM *** (INDIRECT) ***
12860 MN$=MN$+" ("+H$+")"
12870 GOTO12220
12900 :
12999 REM *** MACHINE CODE MONITOR ***
13000 PRINT"J"
13010 FR=FRE(0):PRINT"#":INPUT#1,CO$
13020 IFCO$=""THEN13010
13030 C$=LEFT$(CO$,1)
13040 IFC$="X"THEN10500
13050 IFC$="M"THEN13200
13060 IFC$="."THEN13400
13070 IFC$="F"ORC$="T"THEN13500
13080 IFC$="L"THEN13700
13090 IFC$="S"THEN13800
13100 IFC$="G"THEN14000
13150 PRINT:PRINT"?"ER=0:GOTO13010
13160 :
13199 REM *** DISPLAY MEMORY ON SCREEN ***
13200 IFLEN(CO$)<>11THEN13150
13210 CO$=RIGHT$(CO$,9)
13220 H$=LEFT$(CO$,4):GOSUB11100:IFER=1THEN13150
13230 A1=H
13240 H$=RIGHT$(CO$,4):GOSUB11100:IFER=1THEN13150
13250 A2=H
13260 IFA2<A1THEN13150
13270 PRINT:PRINT:FORI=A1TOA2STEP8
13280 FL=1:H=I:GOSUB11000:FL=0:PRINT"."H$" ";:J=0
13290 H=PEEK(I+J):GOSUB11000:PRINT" "H$;
13295 GETIN$:IFIN$=CHR$(13)THENJ=7:I=A2
13300 J=J+1:IFJ<8THEN13290
13305 FR=FRE(0)
13310 PRINT:NEXT
13320 GOTO13010
13330 :
13399 REM *** MEMORY MODIFY ROUTINE ***
13400 IFLEN(CO$)<>29THEN13150
13410 H$=MID$(CO$,2,4):GOSUB11100:IFER=1THEN13150
13420 AD=H
13430 FORI=6TO27STEP3:IFMID$(CO$,I,1)<>" "THENER=1:I=27
13440 NEXT
13450 IFER=1THEN13150
13460 CO$=RIGHT$(CO$,23)
13470 FORO=1TO23STEP3:H$=MID$(CO$,O,2)
      :GOSUB11100:IFER=1THEN13150
13480 POKEAD,H:AD=AD+1:NEXT
13490 GOTO13010
13494 :
13499 REM *** MEMORY FILL AND MOVE ROUTINES ***
13500 IFC$="T"THEN13510
13502 IFLEN(CO$)<>14THEN13150
13505 D=2:GOTO13520
13510 IFLEN(CO$)<>16THEN13150
13515 D=4
13520 IFMID$(CO$,2,1)<>" "ORMID$(CO$,7,1)<>" "ORMID$
      (CO$,12,1)<>" "THEN13150
13530 H$=MID$(CO$,3,4):GOSUB11100:IFER=1THEN13150
13540 A1=H:H$=MID$(CO$,8,4):GOSUB11100:IFER=1THEN13150
13550 A2=H:H$=RIGHT$(CO$,D):GOSUB11100:IFER=1THEN13150
13560 IFC$="T"THEN13620
13565 :
13569 REM *** FILL MEMORY ***
13570 IFA2<A1THEN13150
13580 IFA1=A2THENPOKEA1,H:GOTO13010
13590 POKE252,A1/256:POKE251,A1-256*PEEK(252)
13600 POKE254,A2/256:POKE253,A2-256*PEEK(254)
13610 POKE2,H:SYS(25610):GOTO13010
13615 :
13619 REM *** MOVE MEMORY ***
13620 IFA2<=A1OR(H<=A2ANDH>=A1)THEN13150
13630 POKE252,A1/256:POKE251,A1-256*PEEK(252)
13640 A2=A2+1:POKE821,A2/256:POKE820,A2-256*PEEK(821)
13650 POKE254,H/256:POKE253,H-256*PEEK(254)
13660 SYS(25639):GOTO13010
13670 :
13700 REM *** LOAD MEMORY FROM TAPE ***
13710 NA$="":IFCO$="L"THEN13730
13720 GOSUB13900:IFER=1THEN13150
13730 POKE2,LEN(NA$):SYS(25704)
13740 H=PEEK(829)+256*PEEK(830):GOSUB11000:SA$=H$
13750 H=PEEK(831)+256*PEEK(832):GOSUB11000:EA$=H$
13760 PRINT:PRINT"CODE LOCATED AT "SA$" TO "EA$
13770 GOTO13010
13780 :
13800 REM *** SAVE MEMORY TO TAPE ***
13810 NA$="":GOSUB13900:IFER=1THEN13150
13820 CO$=RIGHT$(CO$,LEN(CO$)-LEN(NA$)-2)
13830 IFLEN(CO$)<>10THEN13150
13840 H$=MID$(CO$,2,4):GOSUB11100:IFER=1THEN13150
13850 SA=H:H$=RIGHT$(CO$,4):GOSUB11100:IFER=1THEN13150
13860 EA=H:IFEA<=SATHEN13150
13870 POKE252,SA/256:POKE251,SA-256*PEEK(252)
13880 POKE254,EA/256:POKE253,EA-256*PEEK(254)
13890 POKE2,LEN(NA$):PRINT:SYS(25691):GOTO13010
13895 :
13899 REM *** GET FILE NAME FROM CO$ ***
13900 IFMID$(CO$,2,1)<>CHR$(34)THENER=1:RETURN
13910 CO$=RIGHT$(CO$,LEN(CO$)-2):FL=0
13920 ER=1:FORI=1TOLEN(CO$)
13930 IFMID$(CO$,I,1)=CHR$(34)THENI=LEN(CO$):ER=0:GOTO13950
13940 NA$=NA$+MID$(CO$,I,1)
13950 NEXT:IFFL=1THENRETURN
13960 IFLEN(NA$)>16THENER=1
13965 IFER=1ORNA$=""THENRETURN
13970 FORI=1TOLEN(NA$):POKE678+I,ASC(MID$(NA$,I,1)):NEXT
13980 RETURN
13990 :
13999 REM *** EXECUTE MACHINE CODE PROGRAM ***
14000 IFLEN(CO$)<>6THEN13150
14010 H$=RIGHT$(CO$,4):GOSUB11100:IFER=1THEN13150
14020 SYS(H):GOTO13010
14999 :
15000 REM *** PROGRAM EDITOR ***
15010 PRINT"JEDITOR - 'F1' TO RETURN TO MENU"
15020 POKE43,1:POKE44,101
15030 POKE45,PEEK(25000):POKE46,PEEK(25001)
15040 POKE55,0:POKE56,128
15050 CLR
15060 PRINT"#"FRE(0)"BYTES FREE":SYS(25743)
15070 END
15080 :
20000 REM *** PERFORM PASS ONE ASSEMBLY ***
20005 PRINT"JPASS ONE ASSEMBLY":SV=1:AD=0:PA=1
20010 FR=FRE(0):GOSUB21100
20012 IFPEEK(25000)+256*PEEK(25001)=25059THENER=11:GOTO23500
20015 IFNA=0THEN23000
20016 PRINTLN;C$:BV=0:IFOP$=""THEN20010
20017 IFAD>65535THENER=12:GOTO23500
20018 IFOP$="SYM"THEN20010
20019 IFOP$="PRT"THENDV=4:GOTO20010
20020 IFOP$="END"THEN23000
20022 IFLEFT$(OP$,1)="."ANDLEN(OP$)>1THENGOSUB20200
20025 IFLEFT$(OP$,3)="ORG"THENGOSUB20500:GOTO20010
20030 IFLEFT$(OP$,3)="TXT"THENGOSUB20600:GOTO20010
20035 IFLEFT$(OP$,3)="BYT"THENGOSUB20700:GOTO20010
20040 IFVA=1THEN20100
20045 MN$=LEFT$(OP$,3):GOSUB21500
20050 GOSUB21300:IFAM=6ORAM=7ORAM=8THENGOSUB22100
      :GOSUB21700
20060 AD=AD+NB(AM)+1
20070 GOTO20010
20080 :
20100 REM *** ADD VARIABLE TO SYMBOL TABLE ***
20110 GOSUB20300
20120 GOSUB21000:GOSUB22115
20130 SV(SV)=BV
20140 SV=SV+1:GOTO20010
20150 :
20200 REM *** ADD SYMBOLIC ADDRESS TO SYMBOL TABLE ***
20210 OP$=RIGHT$(OP$,LEN(OP$)-1)
20220 GOSUB20300:GOSUB21000
20230 SV(SV)=AD:SV=SV+1
20240 RETURN
20250 :
20300 REM *** REMOVE LABEL NAME ***
20310 IFSV>30THENER=2:GOTO23500
20320 FORI=1TOLEN(OP$)
20330 A$=MID$(OP$,I,1)
20340 IFA$=" "ORA$="="THENI=LEN(OP$):GOTO20370
20350 IF(ASC(A$)<48ORASC(A$)>90)OR(ASC(A$)>57ANDASC(A$)
      <65)THENER=3:GOTO23500
20360 SV$(SV)=SV$(SV)+A$
20370 NEXT
20375 IFLEN(SV$(SV))>6THENER=8:GOTO23500
20380 IFSV=1THEN20420
20390 ER=0:FORI=1TOSV-1:IFSV$(SV)=SV$(I)THENER=1:I=SV-1
20400 NEXT
20410 IFER=1THENER=9:GOTO23500
20420 OP$=RIGHT$(OP$,LEN(OP$)-LEN(SV$(SV)))
20430 RETURN
20440 :
20500 REM *** DEAL WITH ORG DIRECTIVE ***
20510 OP$=RIGHT$(OP$,LEN(OP$)-3):GOSUB21000
20515 GOSUB22115
20520 AD=BV:RETURN
20530 :
20600 REM *** DEAL WITH TXT DIRECTIVE ***
20610 NA$="":OP$=RIGHT$(OP$,LEN(OP$)-3):GOSUB21000
20620 IFLEFT$(OP$,1)<>CHR$(34)ORRIGHT$(OP$,1)
      <>CHR$(34)THENER=10:GOTO23500
20630 CO$=RIGHT$(OP$,LEN(OP$)-1)
20640 FL=1:GOSUB13920:FL=0
20650 IFPA=1THENAD=AD+LEN(NA$):RETURN
20660 H=AD:GOSUB11000:AD$=H$:GOSUB23400
20665 IFNA$=""THENRETURN
20670 FORI=1TOLEN(NA$):A=ASC(MID$(NA$,I,1)):IFA=95THENA=13
20675 POKEAD,A:AD=AD+1:NEXT
20680 RETURN
20690 :
20700 REM *** DEAL WITH BYT DIRECTIVE ***
20710 CO=0:OP$=RIGHT$(OP$,LEN(OP$)-3):GOSUB21000
20715 IFOP$=""THENER=10:GOTO23500
20720 FORI=1TOLEN(OP$)
20730 A$=MID$(OP$,I,1):IFA$=","THENCO=CO+1:GOTO20750
20735 IFA$="$"THEN20750
20740 IF(ASC(A$)<48ORASC(A$)>70)OR(ASC(A$)>57ANDASC(A$)
      <65)THENER=10:I=LEN(OP$)
20750 NEXT:IFA$=","THENER=10
20760 IFER=10THEN23500
20770 IFPA=1THENAD=AD+CO+1:RETURN
20774 :
20775 REM *** PASS TWO 'BYT' ***
20776 FL=1:H=AD:GOSUB11000:AD$=H$:FL=0:GOSUB23400
20780 FORJ=1TOLEN(OP$)
20790 A$=MID$(OP$,J,1)
20800 IFA$=","THEN20830
20810 N$=N$+A$
20820 NEXT
20830 IFLEFT$(N$,1)="$"THEN20860
20840 H=VAL(N$):IFH>255THENER=12:GOTO23500
20845 IFH=0ANDN$<>"0"THENER=10:GOTO23500
20850 GOTO20880
20860 H$=RIGHT$(N$,LEN(N$)-1):GOSUB11100:IFER=1THEN23500
20870 IFH>255THENER=12:GOTO23500
20880 POKEAD,H:AD=AD+1:N$="":IFJ=LEN(OP$)+1THENRETURN
20890 NEXT
20900 :
21000 REM *** REMOVE LEADING SPACES ***
21010 G=LEN(OP$):FORI=1TOG
21020 A$=LEFT$(OP$,1):IFA$=" "ORA$="="THENOP$=RIGHT$
      (OP$,LEN(OP$)-1):GOTO21040
21030 I=G
21040 NEXT
21050 RETURN
21060 :
21100 REM *** GET NEXT LINE OF ASSEMBLY PROGRAM ***
21110 SA=NA
21120 LN=PEEK(SA+2)+256*PEEK(SA+3)
21130 NA=PEEK(SA)+256*PEEK(SA+1):IFNA=0THENRETURN
21140 OP$="":VA=0:SC=0:SM=0
21150 FORI=SA+4TONA-2:A=PEEK(I)
21160 IFA=59THENSC=1:GOTO21180
21161 IFA=34THENSM=1-SM:GOTO21180
21165 IFA=178ANDSC=0THENVA=1
21170 IFA>127ANDSM=0THENOP$=OP$+BK$(A-128):GOTO21190
21180 OP$=OP$+CHR$(A)
21190 NEXT:C$=OP$:IFSC=1THENSC=0:GOSUB23800
21200 G=LEN(OP$):FORI=1TOG
21210 IFRIGHT$(OP$,1)=" "THENOP$=LEFT$(OP$,
      LEN(OP$)-1):GOTO21230
21220 I=G
21230 NEXT
21240 RETURN
21250 :
21300 REM *** IDENTIFY ADDRESSING MODE ***
21310 IFMN$=OP$THENAM=9:RETURN
21315 X=0:Y=0:OP$=RIGHT$(OP$,LEN(OP$)-3):GOSUB21000
21320 A$=RIGHT$(MN$,1):IFLEFT$(MN$,1)="B"ANDA$<>
      "T"ANDA$<>"K"THENAM=10:RETURN
21330 IFOP$="A"THENAM=1:RETURN
21340 IFLEFT$(OP$,1)<>"("THEN21390
21350 IFRIGHT$(OP$,3)=",X)"THENAM=11:X=1:Y=3:RETURN
21360 IFRIGHT$(OP$,3)="),Y"THENAM=12:X=1:Y=3:RETURN
21370 IFRIGHT$(OP$,1)=")"THENAM=13:X=1:Y=1
21375 IFAM=13ANDMN$<>"JMP"THENER=0:GOTO23500
21376 IFAM=13THENRETURN
21380 ER=10:GOTO23500
21390 IFLEFT$(OP$,1)="#"THENAM=2:X=1:Y=0:RETURN
21400 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",Y"THENAM=8:X=0:Y=2:RETURN
21420 AM=6:RETURN
21430 :
21500 REM *** CHECK VALID MNEMONIC ***
21510 T=0:FORI=1TOLEN(T3$)STEP3
21520 IFMID$(T3$,I,3)=MN$THENT=I:I=LEN(T3$)
21530 NEXT
21540 IFT=0THENER=4:GOTO23500
21550 RETURN
21560 :
21600 REM *** REMOVE BRACKETS ETC ***
21610 OP$=LEFT$(OP$,LEN(OP$)-Y)
21620 OP$=RIGHT$(OP$,LEN(OP$)-X)
21630 X=0:Y=0:RETURN
21640 :
21700 REM *** CHANGE FROM ABSOLUTE TO ZERO PAGE ***
21705 IFMN$="JMP"ORMN$="JSR"THENRETURN
21710 IFBV<256THENAM=AM-3
21720 RETURN
21730 :
21800 REM *** CHECK VALID LABEL ***
21810 ER=1:FORI=1TOSV
21820 IFOP$=SV$(I)THENER=0:BV=SV(I):I=SV
21830 NEXT
21835 IFER=1ANDPA=1THENBV=32768:RETURN
21840 IFER=1THENER=5:GOTO23500
21850 RETURN
21860 :
22000 REM *** FIND OPCODE FOR MNEMONIC ***
22010 P1=(T+2)/3:M=0:F=0:OP=0
22020 IFASC(MID$(T4$,P1,1))=1THENOP=ASC(MID$(T5$,P1,1))
      :RETURN
22030 FORI=ASC(MID$(T5$,P1,1))+1TO255STEP4
22040 IFASC(MID$(T1$,I,1))=P1+34THENM=ASC(MID$
      (T2$,I,1))-47:F=F+1
22050 IFM=AMTHENOP=I-1:I=255:GOTO22070
22060 IFF=ASC(MID$(T4$,P1,1))THENI=255
22070 NEXT
22080 IFOP=0ANDMN$<>"BRK"THENER=0:GOTO23500
22090 RETURN
22095 :
22100 REM *** CONVERT OPERAND IN LABEL FORM OR
      HEX TO DECIMAL ***
22110 GOSUB21600:IFOP$=""THENER=10:GOTO23500
22115 GOTO24000
22120 IFLEFT$(OP$,1)="$"THEN22150
22130 BV=VAL(OP$):IFBV=0ANDOP$<>"0"THENGOSUB21800
22140 IFBV>65535THENER=12:GOTO23500
22145 RETURN
22150 H$=RIGHT$(OP$,LEN(OP$)-1):IFH$=""THENER=10:GOTO23500
22155 GOSUB11100:IFER=1THEN23500
22160 BV=H
22170 RETURN
22180 :
22200 REM *** REMOVE LABEL BEFORE PASS TWO ***
22210 G=LEN(OP$):FORI=1TOG
22220 IFLEFT$(OP$,1)<>" "THENOP$=RIGHT$(OP$,
      LEN(OP$)-1):GOTO22240
22230 I=G
22240 NEXT
22250 GOSUB21000
22260 RETURN
22270 :
22300 REM *** RELATIVE ADDRESSING ROUTINE ***
22310 GOSUB22100
22320 OS=AD+2-BV
22330 IFOS>128OROS<-127THENER=6:GOTO23500
22340 IFSGN(OS)=1THENOS=256-OS
22350 BV=ABS(OS):GOTO23150
22360 :
23000 REM *** PERFORM PASS TWO ASSEMBLY ***
23002 PRINT"JPASS TWO ASSEMBLY"
23005 NA=25057:AD=0:OPEN4,DV:PA=2
23007 PRINT#4:PRINT#4,"ADD.   DATA     SOURCE CODE"
23010 FR=FRE(0):GOSUB21100:IFNA=0THEN23600
23020 BV=0:BV$="        ":AD$="    "
23025 IFOP$=""THENGOSUB23400:GOTO23010
23030 IFVA=1THENGOSUB23400:GOTO23010
23035 IFLEFT$(OP$,1)="."THENGOSUB22200
23040 A$=LEFT$(OP$,3)
23050 IFA$="ORG"THENGOSUB23400:GOSUB20500:GOTO23010
23060 IFA$="PRT"THENGOSUB23400:GOTO23010
23070 IFA$="SYM"THENLT=1:GOSUB23400:GOTO23010
23080 IFA$="END"THENPRINTTAB(13)LN;OP$:GOTO23600
23090 IFA$="TXT"THENGOSUB20600:GOTO23010
23095 IFA$="BYT"THENGOSUB20700:GOTO23010
23100 MN$=LEFT$(OP$,3):GOSUB21500
23110 GOSUB21300:IFAM=9THEN23150
23115 IFAM=1THEN23150
23116 IFAM=10THEN22300
23120 GOSUB22100
23130 IFAM=6ORAM=7ORAM=8THENGOSUB21700
23140 IFBV>255ANDNB(AM)=1THENER=7:GOTO23500
23150 GOSUB22000
23160 D1=INT(BV/256):D2=BV-256*D1
23170 H=OP:GOSUB11000:BV$=H$:POKEAD,OP
23180 FL=1:H=AD:GOSUB11000:AD$=H$:FL=0
23190 IFNB(AM)=0THENBV$=BV$+"      ":GOTO23220
23200 H=D2:GOSUB11000:BV$=BV$+H$:POKEAD+1,D2:IFNB(AM)=
      1THENBV$=BV$+"   ":GOTO2322
0
23210 H=D1:GOSUB11000:BV$=BV$+H$:POKEAD+2,D1
23220 GOSUB23400
23230 AD=AD+NB(AM)+1
23240 GOTO23010
23250 :
23400 REM *** OUTPUT ASSEMBLED PROGRAM ***
23410 PRINT#4,AD$"  ";BV$" "LN;C$
23420 RETURN
23430 :
23500 REM *** OUTPUT ERROR MESSAGES ***
23505 IFER<>11ANDPA=2ANDLEFT$(C$,3)<>"BYT"
      THENPRINTTAB(13)LN;C$
23506 IFER=1ANDH>65535THENER=12
23510 PRINT"#":PRINT"?"ER$(ER);" ERROR";
23515 IFER<>11THENPRINT" IN";LN;
23517 PRINT
23520 PRINT"ASSEMBLY TERMINATED"
23530 PRINT"PRESS SPACE":POKE198,0
23540 GETIN$:IFIN$<>" "THEN23540
23550 PRINT"J":RUN
23560 :
23600 REM *** ASSEMBLY COMPLETE ***
23610 IFLT=1THENGOSUB23700
23620 CLOSE4
23630 PRINT"#ASSEMBLY COMPLETE"
23640 GOTO23530
23650 :
23700 REM *** OUTPUT SYMBOL TABLE ***
23705 PRINT#4:PRINT#4
23707 IFSV=1THEN23750
23710 FORI=1TOSV-1:H=SV(I):GOSUB11000:SV$=SV$(I)+LEFT$
      ("      ",6-LEN(SV$(I)))
23720 PRINT#4,SV$,H$
23730 NEXTI
23740 PRINT#4
23750 PRINT#4,"TOTAL NUMBER OF SYMBOLS -";SV-1
23760 RETURN
23770 :
23800 REM *** REMOVE COMMENTS FROM ASSEMBLY
      PROGRAM LINE ***
23810 A$="":FORI=1TOLEN(OP$)
23820 IFMID$(OP$,I,1)=";"THENI=LEN(OP$):GOTO23840
23830 A$=A$+MID$(OP$,I,1)
23840 NEXT
23850 OP$=A$:RETURN
23860 :
24000 REM *** CHECK IF OPERAND CONTAINS +-*/ ***
24010 CO=0:FORI=1TOLEN(OP$):A=ASC(MID$(OP$,I,1))
24020 IFA=43ORA=45ORA=42ORA=47THENCO=CO+1:
      IFCO=1THENFL=I
24030 NEXT
24040 IFCO=0THEN22120
24050 IFCO>1THENER=10:GOTO23500
24060 :
24100 REM *** EVALUATE EXPRESSION ***
24110 LA$=OP$:OP$=LEFT$(OP$,FL-1):GOSUB21200
24120 GOSUB22120
24130 A1=BV
24140 OP$=RIGHT$(LA$,LEN(LA$)-FL+1):FL=0
24145 S$=LEFT$(OP$,1):OP$=RIGHT$(OP$,LEN(OP$)-1)
      :GOSUB21000
24150 GOSUB22120
24160 A2=BV
24170 IFS$="+"THEN24300
24180 IFS$="-"THEN24400
24190 IFS$="/"THEN24500
24200 IFS$="*"THEN24600
24210 STOP
24300 REM *** ADD EXPRESSION ***
24310 BV=A1+A2
24320 IFBV>65535THENER=12:GOTO23500
24330 RETURN
24340 :
24400 REM *** SUBTRACT EXPRESSION ***
24410 BV=A1-A2
24420 IFBV<0THENER=12:GOTO23500
24430 RETURN
24440 :
24500 REM *** DIVIDE EXPRESSION ***
24510 IFA2=0THENER=13:GOTO23500
24520 BV=INT(A1/A2)
24530 RETURN
24540 :
24600 REM *** MULTIPLY EXPRESSION ***
24610 BV=A1*A2
24620 IFBV>65535THENER=12:GOTO23500
24630 RETURN
24640 :
```

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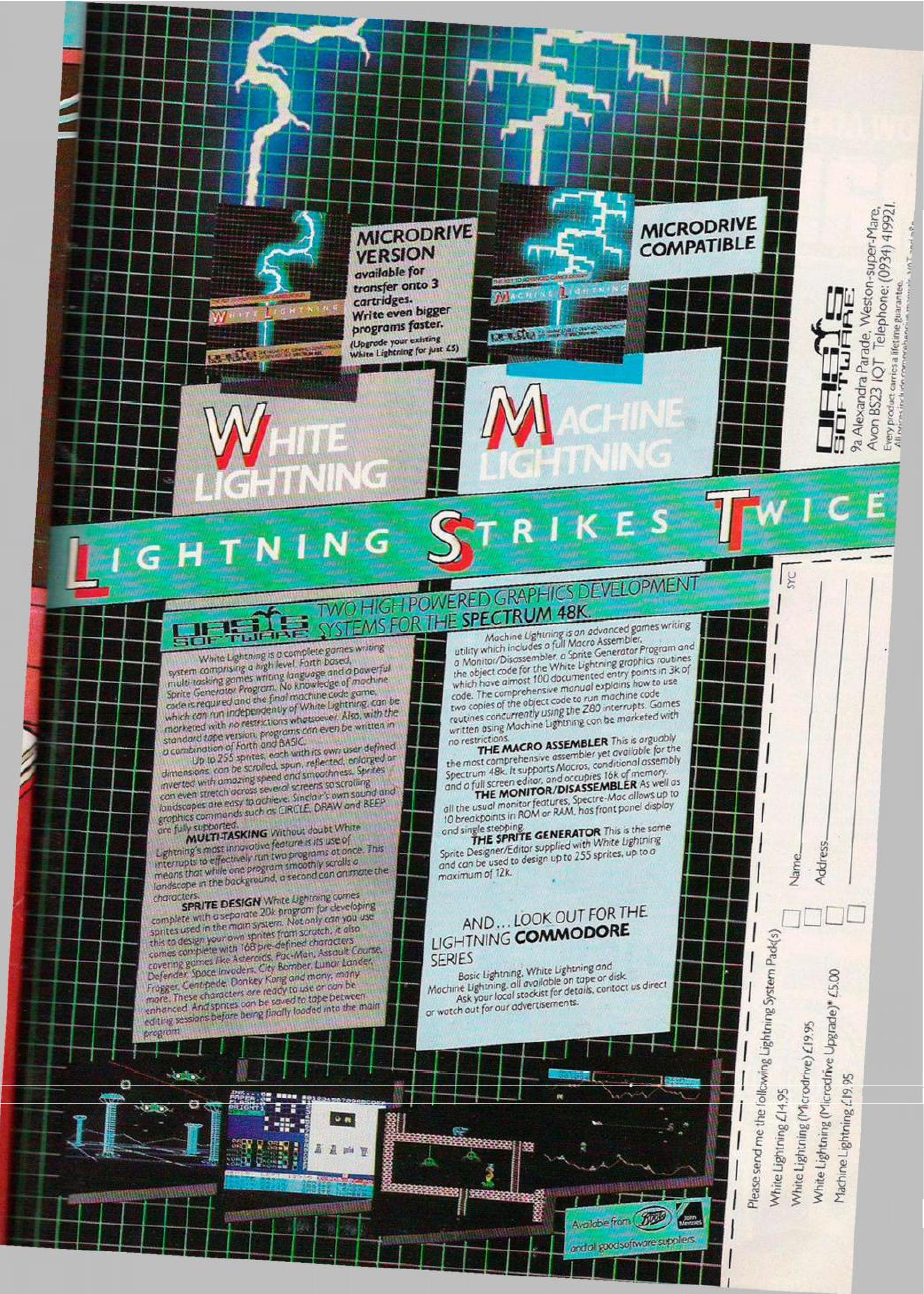

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Machine Lightning is an advanced games writing utility which includes a full Macro Assembler, a Monitor/Disassembler, a Sprite Generator Program and the object code for the White Lightning graphics routines which have almost 100 documented entry points in 3k of code. The comprehensive manual explains how to use two copies of the object code to run machine code routines concurrently using the Z80 interrupts. Games written using Machine Lightning can be marketed with no restrictions.
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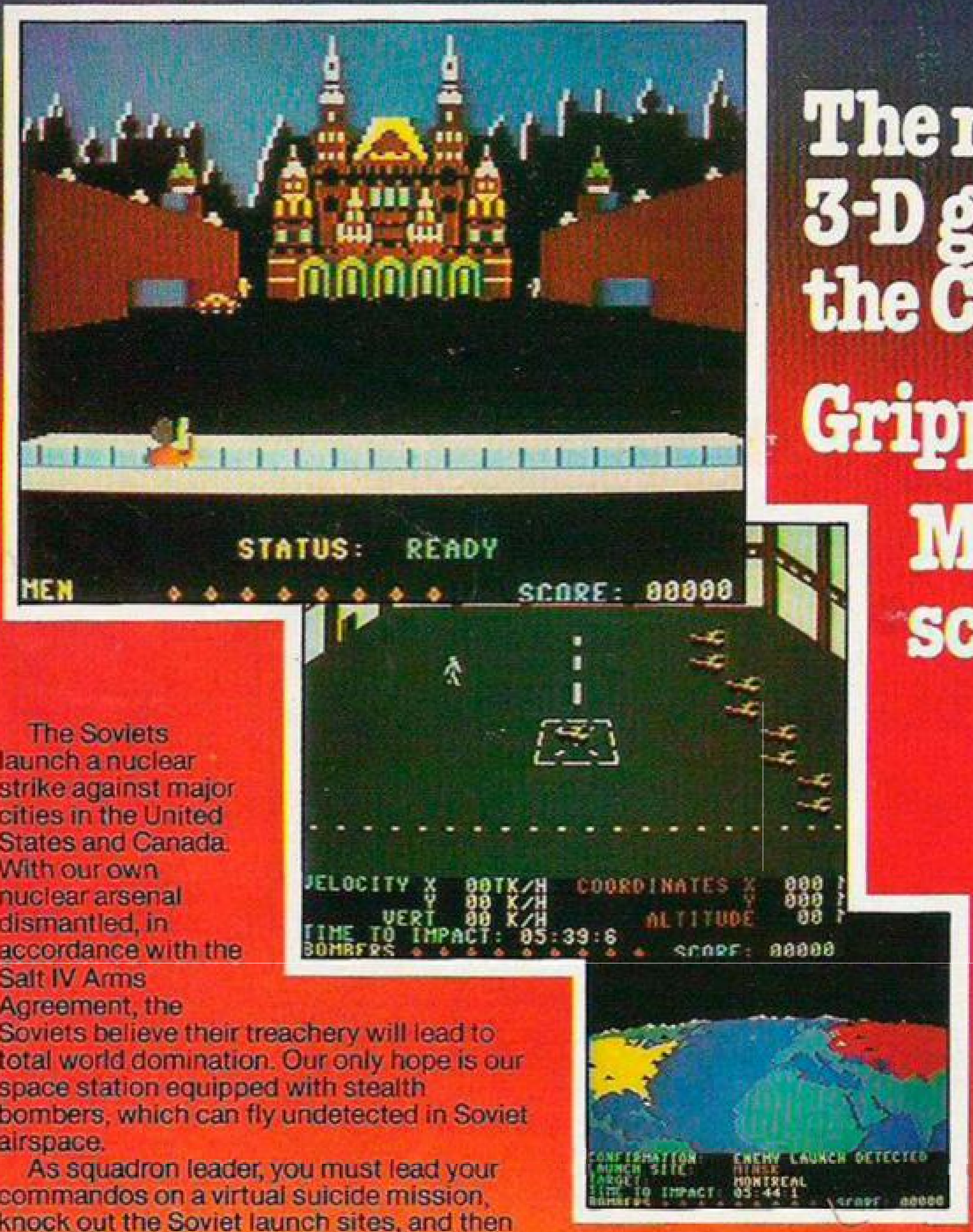

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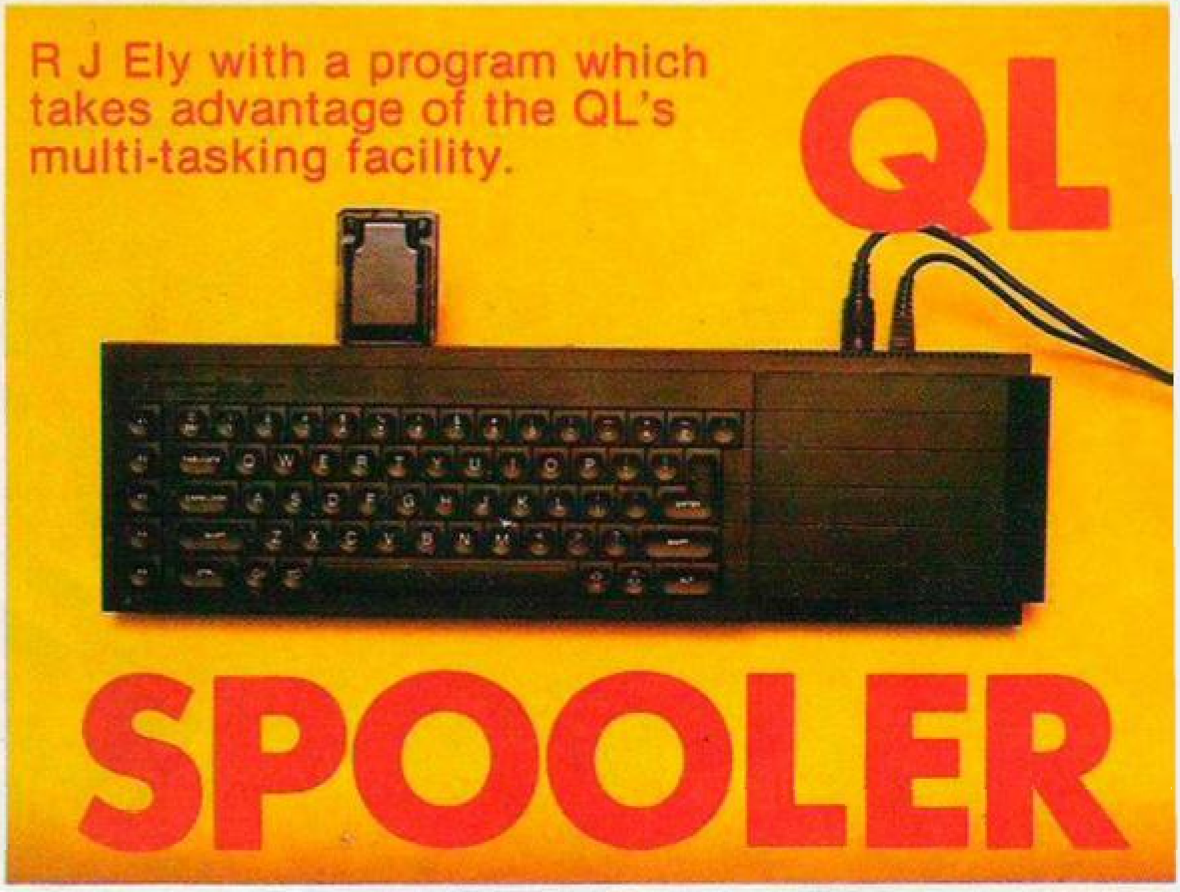

PROGRAMS WRITTEN in machine code are able to take full advantage of the multi-tasking facilities provided by QDOS. Several machine-code programs may be loaded into memory and executed in parallel with each other while Basic is still available to the user.

The example shown here is a print spooler, you can use it to print a file while continuing to use the machine for development.

As well as executing faster than programs written in Basic, machine-code programs are usually smaller. Although this may not seem so important on a machine with over 90K bytes of user memory, remember that the smaller a program is, the faster it loads. Another reason that machine-code programs load faster is that Basic programs require considerable checking and pre-processing during loading.

QDOS provides many system calls that allow the machine-code programmer access to most of the facilities available from Basic as well as many that cannot be used from Basic at all. So that the calls do not change every time a new version of the QL Rom is made, they are all accessed either through traps or via vectors:

Traps use the 68000 Trap instructions. There are 16 of these instructions written

TRAP # 0, TRAP # 1, ... TRAP # 15

Each trap instruction causes a call to the trap routine whose address is contained in the trap vector. The trap vectors occupy addresses 128 to 191 in the Rom, each vector contains a 32 bit pointer to the corresponding trap routine. The trap routines are similar to subroutines except that the status register is pushed as well as the program counter when they are called.

They return using the RTE instruction instead of the RTS instruction. QDOS uses traps 0 to 3 for system calls; the caller uses register D0 to specify which function is requested while additional information is provided in other registers. Most I/O is performed using these trap routines.

System routines that need not be executed in supervisor mode may be called using their vectors in the low part of Rom. Each of these vectors contains the 16 bit address of the subroutine in question — all of these routines are in the first 32K bytes of memory. For instance, the vector for the "print error message" routine is CC hex — or $CC — so to call this routine the following sequence may be used:

```
MOVEA.W @W# $CC,A2 read vector from
                   address $CC into A2
JSR (A2) call the subroutine
                   that A2 points to
```

The @L# prefix is the syntax for absolute word addressing in the assembler used in this example. In some assemblers absolute addressing is assumed if you specify an absolute origin using the Org directive. As Sinclair undertakes not to change the positions of these vectors, it doesn't matter if the actual addresses of the vectored subroutines are different for different versions of the QL Rom.

Machine-code programs for the QL are loaded and run using the Exec command — see QL manual, keywords. Such programs should be position independent or should, when loaded, relocate any part of themselves that is not. This isn't as bad as it sounds since the 68000 was designed to make position independent code easy to write and quick to execute.

The idea is that you assemble your code — preferably using an assembler — in any area of memory that you have reserved for the purpose. The code is then saved in a Microdrive file using the Sexec command — QL manual, keywords — and can be run using the Exec command. QDOS assumes that the program starts at the first byte of the file. It is a convention — which you may ignore — that bytes 8 to n+9 of the code contain the ASCII program name preceded by n, the number of characters in the name.

To reserve an area of memory from Basic you should use the RESPR command — this is not in the QL manual but you can see an example in one of the Boot programs on the bundled software cassettes — for example,

a = RESPR(1024)

will reserve 1024 bytes and return the address of the reserved area in a. Memory thus reserved is only freed when the machine is re-booted.

When a machine-code program, often callec job in the documentation, is run using the Ex command, the program is entered with pointing to the start of the job. A4 holds offset to the job's data area and A5 is an offs to the top of the stack. Two zero words will on the top of the stack.

The print spooler in the example go through the following steps:

- Prompt the user for the name of the file be spooled and read the reply from th console. If they type * exit from the job
- Try to open the file specified, if the ope fails, print an error message and return step 1.
- As no further dialogue is required, clos the console channel and release Basic s that the user may continue with oth tasks.
- Read a line from the file, if it is the end the file exit from the job — after closir the file and the print channel of course.
- Print the line on the printer and loop to

Note that all this could be done using th Copy_N command, the difference is that yo would then have to wait for the printing finish before you could use the computer fo anything else.

If your printer has auto line feed, you shoul omit lines 104 and 105.

This listing was prepared using our ow assembler. It is available for £20 (inc. post an packing) from: QCODE, 42 Swinburne Roa Abingdon, Oxon.

If you have one of the other assemble currently available for the QL, you shoul make the following alterations to listing 1:

- Replace " = " in lines 33 to 41 with "EQU
- Omit the prefix "@W = " in line 76
- User underscore instead of "." in QDO symbols such as IO.OPEN

If you don't have an assembler, listing provides a Basic program to create the spool shown above. When you run this program, will generate the code in memory and save it "mdvl_spooler_code". You should have cassette in mdvl of course. The @W # prefix not mandatory in the latest version (1.04) of th QCode assembler.

(listings on page 179

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Listing 1.

```
  1 0000           *          SPOOLER     copyright (c) 1984  R.J.ELY
  2 0000           *
  3 0000           *          To invoke the spooler type:-
  4 0000           *          EXEC_W MDV1_SPOOLER_CODE
  5 0000           *          the spooler will then run and prompt for a file name
  6 0000           *          Enter the filename, eg
  7 0000           *          FILE>mdv1_spooler_list
  8 0000           *          if the file cannot be found SPOOLER will prompt again.
  9 0000           *          When a valid filename is entered SPOOLER will release
 10 0000           *          the BASIC interpreter to continue with other work,and
 11 0000           *          continue to list the specified file to the device
 12 0000           *          specified at OUTFILE (eg a printer).
 13 0000           *
 14 0000           *          When the job starts
 15 0000           *
 16 0000           *          A6 = start of job area (assembler location counter 0)
 17 0000           *          A6 + A4 = start of jobs data area
 18 0000           *          A6 + A5 = top of data area, also top of stack
 19 0000           *          A7 = top of stack -4, ie there are 2 zero words on the
 20 0000           *              stack
 21 0000           *
 22 0000          D.SPACE=256      This tells the QCODE assembler how much data
 23 0000           *               space is to be allocated for the job.
 24 0000           *
 25 0000 600E           BRA.S    START                entry point from EXEC
 26 0002                DS.B     6-*                  make location counter 6
 27 0006 4AFB           DC.W     $4AFB                flag for QDOS - standard
 28 0008           *                                  format job.
 29 0008 0753           DC.B     7,'SPOOLER'          job name
         504F
         4F4C
         4552
 30 0010           *
 31 0010           *          define some QDOS constants
 32 0010           *
 33 0010          IO.OPEN=1        open a channel
 34 0010          IO.CLOSE=2       close a channel
 35 0010          IO.FLINE=2       fetch a line of characters (lf) terminator
 36 0010          IO.FSTRG=3       fetch a string of bytes
 37 0010          IO.SSTRG=7       send a string
 38 0010          MT.FRJOB=5       force remove job from transient program area
 39 0010          MT.RELJB=9       release a job
 40 0010          UT.ERR=$CC       print error message
 41 0010          ERR.BO=-5        buffer overflow
 42 0010           *
 43 0010 D9CE START     ADDA.L   A6,A4                A4 points to data area
 44 0012 7001           MOVEQ    #IO.OPEN,D0          set up to open channel
 45 0014 72FF           MOVEQ    #-1,D1               job ID,-1 means current
 46 0016 7602           MOVEQ    #2,D3                2 means open new file
 47 0018 41FA           LEA      CONS,A0              address of channel name
         00B0
 48 001C 4E42           TRAP     #2                   open channel
 49 001E 2888           MOVE.L   A0,(A4)              save console channel ID
 50 0020           *                                  Now channel ID is in A0
 51 0020 2054 LOOP      MOVE.L   (A4),A0
 52 0022 7007           MOVEQ    #IO.SSTRG,D0         set up to send string
 53 0024 7405           MOVEQ    #5,D2                number of bytes to send
 54 0026 76FF           MOVEQ    #-1,D3               indefinite timeout
 55 0028 43FA           LEA      PROMPT,A1            point to buffer
         00A6
 56 002C 4E43           TRAP     #3                   send to output
 57 002E           *
 58 002E 7002           MOVEQ    #IO.FLINE,D0         set up to fetch a line
 59 0030 7450           MOVEQ    #80,D2               max length to fetch
 60 0032 43EC           LEA      $10(A4),A1           address to store input
         0010
 61 0036 4E43           TRAP     #3
 62 0038 0C2C           CMPI.B   #'*',$10(A4)         just exit if they type *
         002A
         0010
 63 003E 6700           BEQ.L    EXIT1
         007E
 64 0042 5341           SUBQ     #1,D1                dont count (lf)
 65 0044 3941           MOVE     D1,$E(A4)            length of input string
         000E
 66 0048           *
 67 0048 7001           MOVEQ    #IO.OPEN,D0          set up to open input file
 68 004A 72FF           MOVEQ    #-1,D1
 69 004C 7601           MOVEQ    #1,D3                old (shared) file
 70 004E 41EC           LEA      $E(A4),A0
         000E
 71 0052 4E42           TRAP     #2                   open input file
 72 0054 4A40           TST      D0                   check for errors
 73 0056 670A           BEQ.S    INOK
 74 0058 2054           MOVEA.L  (A4),A0              console channel ID
 75 005A           *                                  error code is in D0
 76 005A 3478           MOVEA.W  @UWUT.ERR,A2         call error printer
         00CC
 77 005E 4E92           JSR      (A2)
 78 0060 60BE           BRA.S    LOOP
 79 0062           *
 80 0062 2948 INOK      MOVE.L   A0,4(A4)             channel ID of input
         0004
 81 0066 7009           MOVEQ    #MT.RELJB,D0         release basic
 82 0068 7200           MOVEQ    #0,D1                basic job ID is 0
 83 006A 4E41           TRAP     #1
 84 006C           *
 85 006C 7002           MOVEQ    #IO.CLOSE,D0         close console
 86 006E 2054           MOVEA.L  (A4),A0
 87 0070 4E42           TRAP     #2
 88 0072           *
 89 0072 7001           MOVEQ    #IO.OPEN,D0          open output channel
 90 0074 72FF           MOVEQ    #-1,D1
 91 0076 7602           MOVEQ    #2,D3
 92 0078 41FA           LEA      OUTFILE,A0           output channel name
         005C
 93 007C 4E42           TRAP     #2
 94 007E 2888           MOVE.L   A0,(A4)              save output channel ID
 95 0080           *
 96 0080 7002 PLOOP     MOVEQ    #IO.FLINE,D0         set up to read input
 97 0082 7451           MOVEQ    #81,D2               max length allow 80 + lf
 98 0084 76FF           MOVEQ    #-1,D3               timeout
 99 0086 43EC           LEA      $10(A4),A1           buffer address
         0010
100 008A 206C           MOVEA.L  4(A4),A0             ID
         0004
101 008E 4E43           TRAP     #3
102 0090 0C40           CMPI     #ERR.BO,D0           check for buffer overflow
         FFFB
103 0094 6608           BNE.S    BOK
104 0096 5241           ADDQ     #1,D1                if so insert linefeed
105 0098 12FC           MOVE.B   #10,(A1)+
         000A
106 009C 4240           CLR      D0
107 009E 4A40 BOK       TST      D0
108 00A0 6614           BNE.S    EXIT
109 00A2 5241           ADDQ     #1,D1                add a carriage return
110 00A4 12FC           MOVE.B   #13,(A1)+            (some printers need it!)
         000D
111 00A8 3401           MOVE     D1,D2                length
112 00AA 7007           MOVEQ    #IO.SSTRG,D0
113 00AC 2054           MOVEA.L  (A4),A0              output ID
114 00AE 43EC           LEA      $10(A4),A1
         0010
115 00B2 4E43           TRAP     #3
116 00B4 60CA           BRA.S    PLOOP
117 00B6           *
118 00B6 7002 EXIT      MOVEQ    #IO.CLOSE,D0         close input and output
119 00B8 206C           MOVEA.L  4(A4),A0
         0004
120 00BC 4E42           TRAP     #2
121 00BE 7002 EXIT1     MOVEQ    #IO.CLOSE,D0
122 00C0 2054           MOVEA.L  (A4),A0
123 00C2 4E42           TRAP     #2
124 00C4           *
125 00C4 7005           MOVEQ    #MT.FRJOB,D0         exit current job
126 00C6 72FF           MOVEQ    #-1,D1               job ID, -1 means current
127 00C8 4E41           TRAP     #1
128 00CA           *
129 00CA 0004 CONS      DC.W     4
130 00CC 434F           DC.B     "CON_"
         4E5F
131 00D0           *
132 00D0 4649 PROMPT    DC.B     "FILE>"
         4C45
         3DFF
133 00D6           *
134 00D6          *OUTFILE  DC.W     16            output device name is 16 bytes
135 00D6           *        DC.B     'SCR_448x60a32x16'
136 00D6           *
137 00D6 0004 OUTFILE DC.W   4        use this OUTFILE instead to send output
138 00D8 5345         DC.B   'SER1'   to a serial printer.
         5231
139 00DC           *
140 00DC          *EOF
D.SPACE =00000100   IO.OPEN =00000001   IO.CLOSE=00000002   IO.FLINE=00000002
IO.FSTRG=00000003   IO.SSTRG=00000007   MT.FRJOB=00000005   MT.RELJB=00000009
UT.ERR  =000000CC   ERR.BO  =FFFFFFFB   START   =00000010   LOOP    =00000020
INOK    =00000062   PLOOP   =00000080   BOK     =0000009E   EXIT    =000000B6
EXIT1   =000000BE   CONS    =000000CA   PROMPT  =000000D0   OUTFILE =000000D6
```

Listing 2.

```
100 REMark basic program to generate mdv1_spooler_code
110 a=RESPR(1024):REMark reserve 1024 bytes of memory for code
120 RESTORE :i=0
130 REPeat rlin
140  READ a$,c:j=1:sum=0:IF a$="END":EXIT rlin
150  REPeat byte
160   b=16*(CODE(a$(j))-48-7*(a$(j)>"9"))+CODE(a$(j+1))-48-7*
      (a$(j+1)>"9")
170   POKE a+i,b:j=j+2:i=i+1:sum=sum+b
180   IF j>=LEN(a$):EXIT byte
190  END REPeat byte
200  PRINT sum
210 END REPeat rlin
215 DELETE MDV1_SPOOLER_CODE
220 SEXEC "mdv1_spooler_code",a,i,256
230 DATA "600E000000004AFB0753504F4F4C4552",1
240 DATA "D9CE700172FF760241FA00B04E422888",2
250 DATA "20547007740576FF43FA00A64E437002",3
260 DATA "745043EC00104E430C2C002A00106700",4
270 DATA "007E53413941000E700172FF760141EC",5
280 DATA "000E4E424A40670A2054347800CC4E92",6
290 DATA "60BE29480004700972004E4170022054",7
300 DATA "4E42700172FF760241FA005C4E422888",8
310 DATA "7002745176FF43EC0010206C00044E43",9
320 DATA "0C40FFFB6608524112FC000A42404A40",10
330 DATA "6614524112FC000D34017007205443EC",11
340 DATA "00104E4360CA7002206C00044E427002",12
350 DATA "20544E42700572FF4E410004434F4E5F",13
360 DATA "46494C453DFF000453455231",14
370 DATA "END",1
```

VIC-2?

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Still available: 'Programming The PET/CBM' £14.90 from the same address.
Available soon: 'Programming The Commodore 64'. (March 1985; when the 64 becomes the biggest-selling computer!)

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

SOUND ADVICE

I am the proud owner of an Amstrad 64. I am currently trying to write a *Space Invaders* type program. The thing that bothers me is that I can't really make head nor tail of the Envelope command. Although I can do simple things like Bleeping with

```
PRINT CHR$(7)
```

I am totally at sea with more difficult things. Is there a simple way to get "laser fire" effects that I can use in my program without just experimenting with random parameters?

Janus y'Hadouzi,
London SE15.

I AGREE THAT the Envelope can be pretty hard to master. Perhaps the best way to discover good sounds is to create a program which generates the sound parameters at random, makes the sound, and most importantly, then prints the relevant parameters on the screen so you can make a note of the ones which sound effective.

You'll find you can try out many, many sounds very easily with such a program. To start you off, try including this in a program:

```
ENT -2,6,-1,2,2,5,1
```

The following line in your program should be

```
SOUND 2,196,497,13,0,2
```

This will show you how much you can produce in the sound department with your Amstrad and should fit your *Space Invaders* program.

80K SPECTRUM?

I am hoping to get a 48K ZX Spectrum. Before I decide to get one, I would like to know if it is possible to upgrade the memory with 80K with a 32K Ram pack.

Stephen Peters,
Stoney Middleton.

YOU CAN UPGRADE a 16K Spectrum to 80K with a memory expansion kit from East London Robotics, but as far as I can determine, it is not possible to upgrade a 48K machine to 80K.

FASTER ELECTRON

I own an Acorn Electron and am very pleased with it, but I find it most frustrating when — after typing out games written for the BBC Micro — to find that they are very slow. This, of course, very much limits the attraction of the game. I've found that even games by software houses which are written in machine code for the BBC — such as A&F's *Chuckie Egg* — run at a snail's pace. Is there any way in which I can speed up games with such things as a special Poke, or a short assembler routine?

Neil Smith,
Finchfield,
Wolverhampton.

THERE ARE A NUMBER of ways you can speed programs up. Remove as many spaces from the listings as possible, and use multi-statement lines where possible. Resident integer variables — such as A% — run more quickly than any other variables, so use these if you can. It appears that, especially in shorter programs, Gotos and Gosubs run more quickly than procedures.

Put frequently called Gosubs as close to the start of the listing as you can. As a general rule, low-resolution screen modes — 4,5 and 6 — tend to run more quickly than 0 through to 3, so try the effect of modifying the mode.

SCREEN EFFECT

I have written a number of useful programs for my own use, and have incorporated various Screen$ to look at while the main program is loading. However, after loading the Screen$, and the main program has started loading, the computer prints up "program: name" right in the middle of my carefully-drawn Screen$, ruining the whole effect. I cannot predict where this line is going to be printed. Is there any way of preventing the computer from printing the program name when it starts to load?

Ian Philpot,
Tonbridge,
Kent.

THE EASIEST WAY to do this is to leave the top line of your Screen$ blank, and ensure the Ink and Paper colours are finally set to the same colour. You then end with a Print At 0,0; which will put the "program: name" message — invisibly — on the top line. If you would prefer to use the bottom part of the screen, rather than the top line, you can use Poke 23659,0 to make the bottom lines available, and use Print At 24,0;. If you do this, you need to make Poke 23659,2 the first line of your main program, or else your main program will crash.

HALL OF FAME

I have recently been developing a Hall of Fame for a game I am programming, but I cannot seem to get it to work. I have tried various different ways, yet still I have had no luck. Could you please put me out of my suspense and tell me how I could do it?

C Jones,
Appley Bridge.

I WAS SURPRISED to discover that it was not as simple to do this as I had thought when first reading your letter. After quite a bit of experimenting I came up with the following. It will work as listed on the Spectrum or QL, and on most other machines by deleting the comma and second 10 in the A$ Dim statement.

If you run this, you'll see scores being generated at random, with a random letter for the name of the winner. You'll also see the table being constantly updated.

```
10  DIM A$(10,10):DIM B(10)
20  FOR J=1 TO 10
30  A$(J)="Z"
40  NEXT J
50  SCORE=INT(RND.100)+1
60  N$=CHR$(64+INT(RND*26))
70  GO SUB 160
80  CLS
90  PRINT "SCORE IS ";SCORE
100 PRINT
110 FOR J=1 TO 10
120 PRINT A$(J),B(J)
130 NEXT J
140 FOR T=1 TO 300:NEXT T
150 GO TO 50
160 FLAG=0
170 FOR J=10 TO 1 STEP -1
180 IF SCORE>B(J) THEN
      FLAG=J
190 NEXT J
200 IF FLAG=0 THEN RETurn
210 FOR J=10 TO FLAG STEP -1
220 B(J=B(J - 1)
230 A$(J)=A$(J - 1)
240 NEXT J
250 B(FLAG)=SCORE
260 A$(FLAG)=N$
270 RETurn
```

COPYRIGHT ROM?

We are writing a program for the Spectrum which we wish to sell. Its main function is performed by Calls to the Rom. A lot of commercially-available programs also do this. However we would like to know if it infringes Sinclair's copyright on the Rom.

C Stockley,
Dorset.

USING THE Rom in this way comes well within the "normal use" of a computer. There are no copyright problems.

DRAGON FORTH

I own a Dragon 32, and have lots of games for it. I recently started machine code programming, but have encountered a problem. A lot of my games run automatically on loading, but nowhere in any machine code books can I find details of how to do this. Secondly, I am looking for a Forth compiler for the Dragon. There are several on the market, but I don't know which is the best value for money. Can you recommend one?

David Kelsey,
Saxby-on-Humber,
Grimsby.

ACCORDING TO the Dragon Data magazine *Dragon World* there is no easy way to achieve an auto-run on the Dragon. In regard to the Forth question, I read a very good review of the Forth from Oasis Software. *The Dragon Dungeon* praised the Forth from Oasis quite highly. It comes with a 58-page booklet, and allows you to use Dragon graphics and sound. Of special interest is a demonstration program which shows the dramatic speed difference between Forth and Basic.

INPUT PROBLEM

I am presently writing an adventure program and have encountered a problem, which involves the input of commands into the program. For example if I wanted to go to the north with a commercial adventure I would just type in Go North and the computer would know what to do. I am looking for a subroutine that is connected to the word — that is, move north to a new location.

Matthew Norman,
Oldbury Warley.

THE ROUTINE you include in your letter is messy. It is also unnecessary. If you insist your player start a direction command with "Go" you only need to check the fourth letter of the input to see what direction the person wishes to move. You could simply use the following — assuming that you have already checked to see that the first two letters of the input are "Go", and assuming the input string is A$:

```
IF A$(4)="N" THEN GOSUB ....
IF A$(4)="S" THEN GOSUB ....
IF A$(4)="E" THEN GOSUB ....
IF A$(4)="W" THEN GOSUB ....
```

ZX-81 INPUT

I know it is easy on the Spectrum to direct the computer to put an input anywhere on the screen. However, I have a ZX-81, and I would like to be able to do this on my computer.

Robert Geeson,
Edinburgh.

THIS PROGRAM, from Michael Erichson allows you to make an input anywhere on the screen:

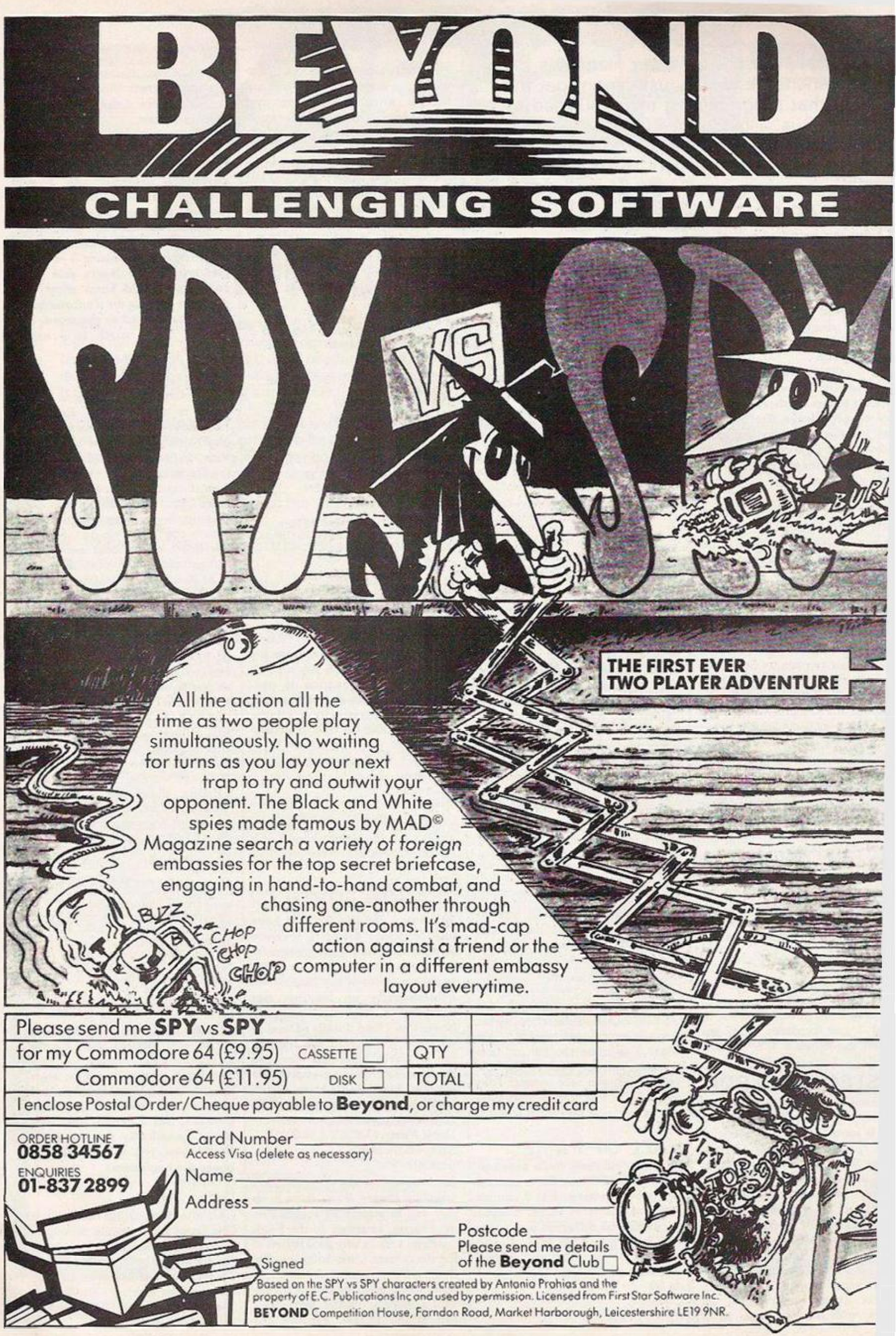
```
10  PRINT "QUESTION?";
20  LET A$=" "
30  FOR N=1 TO 32
40  IF INKEY$=" " THEN GOTO
      40
50  IF CODE INKEY$=118 THEN
      GOTO 120
60  LET A$=A$+INKEY$
70  IF INKEY$<>"" THEN GOTO
      70
100 PRINT A$(N);
110 NEXT N
120 CLS
130 PRINT A$
140 PRINT LEN A$
```

MC FOR THE ORIC

After reading *Your Computer* for several months now, I have noticed that quite a few Spectrum owners want to start programming in machine code. I am an Oric owner in the same position, but I cannot find any books specifically for the Oric. Could you tell me about any books for beginners?

D Edwards,
Tiverton, Devon.

GRANADA PUBLISHING have three Oric books which should be helpful to you. These are: *Oric and Atmos Machine Code* (Ian Sinclair - £6.95), *The Oric 1 — and how to get the most out of it* (Ian Sinclair - £5.95), and *The Oric Programmer* (S M Gree and Mike James, £6.95).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QTY
TOTAL
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Chambers

M Bristow,
Alderney,
Channel Islands.

SPECTRUM

YOU PLAY the part of Spiteful Sorcerer Sly's apprentice. He has locked you in the cellar of his tower full of mysterious rooms and chambers. To test your intelligence he has given you the task of finding your way out through an exit on the fifth floor. But not only this, you must also collect one of each of the valuable objects left in the rooms, or he may cast a spell on you. Just to make it more difficult, Sorcerer Sly has put a few hazards on the way!

Press M to see your position on the map at any time during the game, but be warned you can see the maps only a limited number of times. Press I to see what items you have collected so far.

Press 0 if you want to unlock an invisible door. But remember, if you press it at the wrong time, you will fall through the floor — creating a trap door. Press cursor keys (5-8) to move through the maze.

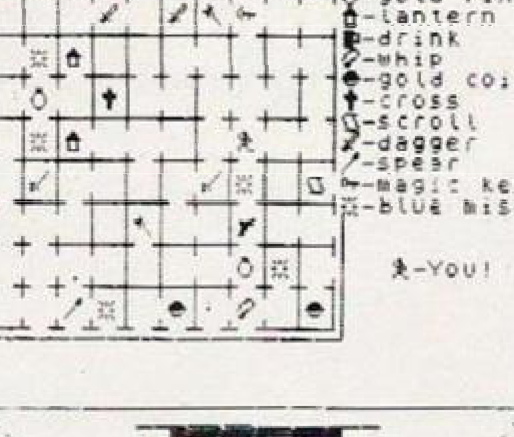
To reach the level above you, you must reach one of the exits on the outside walls. You may find it useful to collect a lantern, a cross and a magic key to help you on your way!

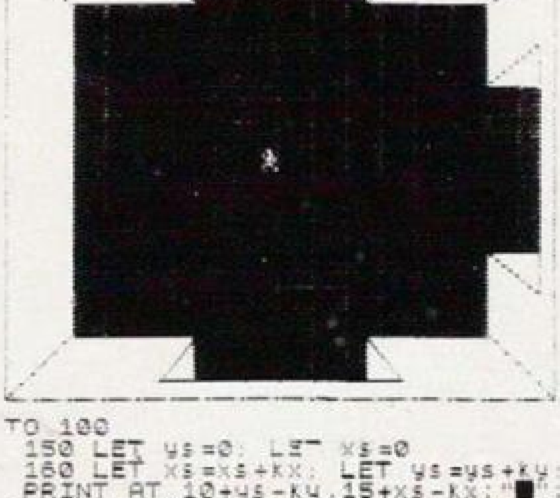
Program notes.

10 Sets up variables.
20 Constructing maze.
25 Loop for number of levels.
30-90 Draw room which you are in.
95 Moves man to centre of room.
96 Sees if you have come across an object or a hazard.
97 Sees if you have come across vanishing room.
98 Sees if you have come across a va pire bat.
100-140 Waits for you to press a key a responds accordingly.
150-170 moves man out of door.
180-190 checks to see if you have got c of maze.
200-290 End of game and an assessme of your intelligence.
300-380 Reacting to you trying to (through an invisible door.
400-490 Draws map — if you have any le
500-590 tells you what type of object hazard you've come across.
700-710 Lists the items you are carrying
800-850 Vanishing room.
900-940 Vampire bats.
9000 Reads and Pokes Data for us defined graphics.
9010-9060 Data for graphics.
9090 Reads Data for objects and hazard
9100-9200 Data for objects and hazards.
9210-9300 Asks you to wait while maze constructed.
9999 Saves and Verifies a copy Chambers.

Simply type in the main program and Save copy of it by Entering Goto 9999. Then r wind tape and press play to Verify it.

```
  10 CLEAR : RANDOMIZE : GO SUB
9000: LET life=5: DIM p$(704): D
IM j(5): DIM k(5): DIM i$(20,9):
 LET nu=1: LET x=5: LET y=5: DIM
 x(5,11,11): DIM y(5,11,11): DIM
 p(5,11,11): DIM t(5,11,11)
  20 FOR l=1 TO 5: LET k(l)=ABS
(8-l): BORDER l: FOR m=1 TO 11:
FOR n=1 TO 11: LET x(l,m,n)=INT
(RND*2): LET y(l,m,n)=INT (RND*2
): LET p(l,m,n)=INT (RND*8): LET
 t(l,m,n)=(RND>.6)*INT (RND*17+1
): NEXT n: NEXT m: NEXT l
  25 FOR l=1 TO 5
  30 LET xs=0: LET ys=6: LET ky=
1: LET kx=0: LET a$="6": BRIGHT
1
  40 BORDER p(l,x,y): PAPER p(l,
x,y): CLS : INK 9: PRINT #0;AT 1
,1;"Level ";l
  50 DRAW 255,0: DRAW 0,175: DRA
W -255,0: DRAW 0,-175: DRAW 30,2
4: PLOT 255,0: DRAW -30,24: PLOT
 255,175: DRAW -30,-24: PLOT 0,1
75: DRAW 30,-24: FOR n=3 TO 18:
PRINT AT n,4;"████████████████████
████████": NEXT n
  55 IF t(l,x,y)>1 THEN PRINT OV
ER 1;AT 10,15;CHR$ (145+t(l,x,y)
)
  60 IF y(l,x,y)=1 THEN PLOT 88,
152: DRAW -16,16: DRAW 112,0: DR
AW -16,-16: FOR n=1 TO 3: PRINT
AT n,11;"██████████": NEXT n
  70 IF y(l,x,y+1)=1 THEN PLOT 8
8,23: DRAW -16,-16: DRAW 112,0:
DRAW -16,16: FOR n=17 TO 20: PRI
NT AT n,11;"██████████": NEXT n
  80 IF x(l,x,y)=1 THEN PLOT 31,
56: DRAW -24,-16: DRAW 0,96: DRA
W 24,-16: FOR n=7 TO 14: PRINT A
T n,1;"███": NEXT n
  90 IF x(l,x+1,y)=1 THEN PLOT 2
24,56: DRAW 24,-16: DRAW 0,96: D
RAW -24,-16: FOR n=7 TO 14: PRIN
T AT n,27;"███": NEXT n
  95 LET ys=ys-ky: LET xs=xs-kx:
 PRINT AT 10-ys-ky,15-xs-kx;"█";
AT 10-ys,15-xs; OVER 1;"B": BEEP
 .01,-5: IF ys<>0 OR xs<>0 THEN
GO TO 95
  96 IF (t(l,x,y)>0 AND l>1) OR
t(l,x,y)>1 THEN GO SUB 500: IF t
(l,x,y)=1 THEN LET l=l-1: GO TO
30
  97 IF t(l,x,y)=16 THEN GO SUB
800
  98 IF t(l,x,y)=17 THEN GO SUB
900: IF life=0 THEN PRINT AT 18,
0;#0;AT 0,0;"Sorry, you have bee
n wounded toomany times.  You ar
e dead!": GO TO 260
 100 LET a$=INKEY$
 110 LET kx=(a$="8" AND x(l,x+1,
y)=1)-(a$="5" AND x(l,x,y)=1): L
ET ky=(a$="6" AND y(l,x,y+1)=1)-
(a$="7" AND y(l,x,y)=1)
 120 IF a$="0" THEN GO TO 300
 130 IF a$="m" THEN GO TO 400
 135 IF a$="i" THEN GO TO 700
 140 IF (kx=0 AND ky=0) THEN GO
```





```
TO 100
 150 LET ys=0: LET xs=0
 160 LET xs=xs+kx: LET ys=ys+ky:
 PRINT AT 10+ys-ky,15+xs-kx;"█";
AT 10+ys,15+xs; OVER 1;"B"
 170 BEEP .01,-5: IF 8-ABS ys>0
AND 13-ABS xs>0 THEN GO TO 160
 180 LET x=x+kx: LET y=y+ky: IF
x>0 AND x<11 AND y>0 AND y<11 TH
EN GO TO 40
 190 PRINT #0; FLASH 1;AT 0,0;"
You have found one of the exits
 Press a key for next level.";AT
 1,12;("to get out of maze." AND
 l=5): PAUSE 0: LET x=5: LET y=5
: NEXT l
 200 CLS : PRINT AT 1,10;"WELL D
ONE""You have managed to escape
 from the fifth level alive."
 210 LET c=1: PRINT AT 4,0: FOR
n=2 TO 14: IF i$(n)<>t$(n) THEN
PRINT AT 4,0;"But you did not ha
ve all the      items required by
the sorcerer.  You remain an app
rentice until      next time!": L
ET c=0
 220 NEXT n
 230 IF c=1 THEN PRINT AT 4,0;"Y
ou have got all the items. The s
ourcerer is pleased with you   a
nd has made you his partner."
 240 PRINT #0;AT 0,0;"Would You
like to see the items you found"
  (Y/N)"
 245 LET a$=INKEY$
 250 IF a$="y" THEN CLS : PRINT
AT 1,5;"You are carrying:-": FOR
 n=2 TO 14: PRINT AT n,10;CHR$ (
145+n);" - ";i$(n): NEXT n
 255 IF a$<>"y" AND a$<>"n" THEN
 GO TO 245
 260 PRINT OVER 1;"          Anothe
r go ? (Y/N)"
 270 LET a$=INKEY$: IF a$="y" TH
EN RUN
 280 IF a$<>"n" THEN GO TO 270
 290 STOP
 300 IF i$(14)<>t$(14) THEN PRIN
T #0;AT 0,0;"No key?-Secret door
s stay locked";("You decompose o
n the floor" AND l=1);("You fall
 through the floor" AND l>1): LE
T t(l,x,y)=1: PAUSE 0: GO TO (l<
>1)*86+10
 310 PRINT #0;AT 0,0; FLASH 1;"
    Open the secret door...    U
sing cursor keys (5-8)          "
 320 LET a$=INKEY$
 330 IF a$="5" THEN LET x(l,x,y)
=1
 340 IF a$="8" THEN LET x(l,x+1,
y)=1
 350 IF a$="7" THEN LET y(l,x,y)
=1
 360 IF a$="6" THEN LET y(l,x,y+
1)=1
 370 IF a$<>"5" AND a$<>"6" AND
a$<>"7" AND a$<>"8" THEN GO TO 3
20
 380 PRINT #0;AT 1,0;"The key ru
sts as the door opens.": LET i$(
14)="rusty key": GO TO 60
 400 IF k(l)=0 THEN PRINT #0;AT
0,0;"...You have run out of maps
...": GO TO 100
 405 LET k(l)=k(l)-1: PAPER 0: B
ORDER 0: INK 7: CLS : DRAW 168,0
: DRAW 0,168: DRAW -168,0: DRAW
0,-168: FOR n=1 TO 15: PRINT AT
n,21; INK 4;CHR$ (145+n);"-";t$(
n): NEXT n: PRINT AT 18,24;"B-Yo
u!";AT 0,0; PAPER 6; INK 0;"You
have ";k(l);" map";("s" AND k(l)
<>1);" left on level ";l
 410 PRINT INK 0;AT 2*y,2*x-1;"B
"
 430 FOR m=0 TO 10: PLOT 16*m+4,
4: DRAW 0,160: PLOT 4,16*m+4: DR
AW 160,0: NEXT m
 440 FOR n=1 TO 11: FOR m=1 TO 1
1: IF m<11 THEN PLOT 16*m,180-16
*n: DRAW OVER y(l,m,n);-8,0
 445 IF t(l,n,m)>0 AND m<11 AND
n<11 AND (t(l,n,m)<>1 OR l<>1) T
```

(continued on page 185)

The Key To Success!

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(continued from page 183)

```
HEN PRINT INK 0;AT 2*m,2*n-1;CHR
$ (145+t(l,n,m))
 450 IF n<11 THEN PLOT 16*m-12,1
76-16*n: DRAW OVER x(l,m,n);0,-8
 460 NEXT m: NEXT n
 470 INK 9: FOR m=4 TO 164: OVER
 1: PLOT 4,m: DRAW 160,0
 480 IF INKEY$="" THEN NEXT m: G
O TO 470
 490 OVER 0: PAUSE 0: GO TO 40
 500 FOR n=9 TO 11: PRINT AT n,1
4;"   ": NEXT n
 530 FOR n=15 TO 1 STEP -1: BEEP
 .01,n: NEXT n
 540 LET t=t(l,x,y): PRINT AT 10
,15;CHR$ (145+t);#0;AT 0,0;"You
have come across a ";t$(t): IF t
>1 AND i$(t)=t$(t) AND t<16 THEN
 PRINT #0;AT 1,0;"But it breaks
up in your hands!!"
 550 IF t=1 THEN FOR n=7 TO 13:
PRINT AT n,12;"       ": NEXT n:
 PLOT 96,119: DRAW 55,0: DRAW 0,
-55: DRAW -55,0: DRAW 0,55: DRAW
 54,-54: DRAW -54,0: DRAW 54,54:
 FOR n=8 TO 12: PRINT BRIGHT 0;A
T n,13; INK p(l-1,x,y);"█████":
NEXT n: PRINT #0;"You fall into
the chamber below.": PAUSE 0
 560 IF t=15 THEN PRINT #0;AT 1,
0;("It is evaporated by the lant
ern!" AND i$(6)=t$(6)): IF i$(6)
<>t$(6) THEN PRINT #0;AT 1,0;"It
 absorbes all your possessions":
 PRINT AT 0,0; OVER 1; PAPER 5;
INK 1; FLASH 1;p$: DIM i$(20,9):
 590 LET i$(t)=(t$(t) AND t>1 AN
D t<16): LET t(l,x,y)=(t(l,x,y)=
1)+(t(l,x,y) AND t(l,x,y)>15): R
ETURN
 700 CLS : PRINT AT 1,5;"You are
 carrying:-": FOR n=2 TO 14: IF
i$(n)=t$(n) OR i$(n)="rusty key"
 THEN PRINT AT n,10;CHR$ (145+n)
;" - a ";i$(n)
 710 NEXT n: PAUSE 0: GO TO 30
 800 PRINT AT 0,0; PAPER 7; INK
0; OVER 1; FLASH 1;p$
 810 LET t=0: FOR n=1 TO 14: IF
i$(n)=t$(n) THEN LET t=n
 820 NEXT n
 830 IF i$(6)=t$(6) THEN LET t=6
 840 IF t>1 THEN PRINT #0;AT 1,0
;"room.You've lost your ";i$(t):
 LET i$(t)="  ": PAUSE 0: RETURN

 850 PRINT #0;AT 1,0;"room. Luck
ily nothing vanished.": PAUSE 0:
 RETURN
 900 PRINT #0;AT 1,0;"Bat.  Pres
s a key to attack it.": PAUSE 0:
 PRINT #0;AT 0,0;"

                                "
 910 FOR m=0 TO 7: PRINT AT 10,1
5;"S";AT 10,15;("O" AND m/2=INT
(m/2)): BORDER m: FOR n=20 TO 1
STEP -1: BEEP .005,n+m: NEXT n:
NEXT m
 920 IF i$(10)=t$(10) THEN PRINT
 AT 10,15;" ";#0;AT 0,0;"You hav
e killed the vampire bat with yo
ur cross.": LET t(l,x,y)=0: RETU
RN
 930 LET life=life-1: IF life>0
THEN PRINT #0;AT 0,0;"You are wo
unded.  You have ";life;"   "
lif";(CHR$ 8+"v" AND life<>1);"e
";("s" AND life<>1);" left. Esca
pe while you can": RETURN
 940 RETURN
9000 RESTORE 9000: FOR n=USR "a"
 TO USR "s"+7: READ a: POKE n,a:
 NEXT n
9010 DATA 153,102,102,153,153,10
2,102,153
9015 DATA 48,176,152,116,20,112,
136,134,255,129,189,189,189,189,
129,255
9020 DATA 1,2,4,8,208,160,208,12
8,32,48,240,104,40,4,2,1,127,119
,119,65,119,54,54,28,56,56,68,13
0,130,130,68,56
9030 DATA 16,56,124,254,68,68,68
,124,0,120,127,121,121,127,120,1
20,14,49,65,66,140,48,112,96,0,6
0,126,255,189,66,60,0
9040 DATA 24,24,126,126,24,24,24
,24,0,126,132,132,66,66,33,126,3
,5,10,84,40,112,232,64
9050 DATA 3,7,6,8,16,32,64,128,0
0,64,160,191,165,68,0,0,0,146,84
,0,198,0,84,146,0
9060 DATA 0,0,0,0,0,0,0,0,3,110,
126,56,112,96,224,128
9090 DIM t$(20,9): RESTORE 9100:
 FOR n=1 TO 17: READ a$: LET t$(
n)=a$: NEXT n
9100 DATA "trap door","sword","h
atchet","shield","gold ring","la
ntern","drink","whip","gold coin
","cross","scroll"
9200 DATA "dagger","spear","magi
c key","blue mist","vanishing","
vampire"
9210 CLS
9220 PRINT AT 10,5;"Please wait
while the";AT 11,5;"sorcerer prp
ares your";AT 12,5;"task.  -Good
 luck.  "
9300 RETURN
9999 SAVE "Chambers" LINE 10: PR
INT AT 10,10;"V E R I F Y": VERI
FY "": RUN
```

Bug Eater

S Shirley,
Aglestone,
Leicestershire.

BUG EATER RUNS on a CBM-64 with joystick in port two. It uses sprites, user-defined characters and limited sound. In writing this program I have explored most features of the CBM-64 and also learnt some useful programming techniques.

- The use of For-Next loops instead of if there loops in order to increase speed.
- The need to minimise the number of Peeks, Pokes and If-Thens in the main loop because they are so flawless.
- The use of integer variables instead of numbers in order to increase speed.
- The use of boolean arithmetic to replace If-Then statements. If should be noted that though this saves space it also slows things down.
- Never use Def FN as this is really slow.
- The importance of efficient program structure in terms of executive time.

If you think the program is initially slow then kill line 132 which serves as a speed control. To make the clumps of grass a bit more of a challenge then change the following line:

(continued on page 189)

```
5 PRINT"⌐":GOSUB 9000:DIM P(300)
10 GOSUB 7000
100 REM*******MAIN PROGRAM*************
120 FOR F=F% TO Z%
130 FOR W=G% TO C%
132 FOR X=G%TO(D%-LE):NEXT
140 A=PEEK(AA):H=H+F%+((H>Q%)*H%):T=H-L-((H-L<0%)*Q%):IF A<>B% THEN B=A
150 P(H)=S+FN F2(B):S=P(H):C=PEEK(P(H)):POKE P(H),B:POKE P(T),I%
160 IF C=I% THEN 250
170 IF C=J% THEN SC=SC+V%:L=L+LL:PRINT"⌐££££££SCORE"SC:GOTO 250
180 GOTO 1000
250 NEXT
270 R=RND(F%)*R%+R%:IF PEEK(R)=I% THEN POKE R,J%:POKE R+NN,T%
280 NEXT
290 GOTO 4000
1000 REM*******LOOSE A LIFE*************
1023 POKE 54276,0:IF C=0 THEN 1505
1027 POKE 54277,26:POKE 54278,12:POKE 54273,244:POKE 54272,103:POKE 54276,129
1030 PRINT"⌐":POKE 53280,0:POKE 53281,0:LI=LI-1:IF LI=0 THEN 5000
1070 GOSUB2000:POKE 53280,CO:POKE 53281,CO:S=1440:FOR I=1 TO 300:P(I)=1065:NEXT
1100 POKE54277,17:POKE 54278,32:POKE 54273,10:POKE 54272,60:GOTO 250
1505 TT=T:POKE 54277,26:POKE 54278,12:POKE 54273,1:POKE 54272,233:POKE 54276,33
1510 POKE P(TT),32:TT=TT+1
1530 IF TT>300 THEN TT=TT-300
1540 IF INT(TT)=H THEN 1030
1550 GOTO 1510
2000 REM*******BORDER******************
2025 SYS49160:POKE V+21,0:POKE 1441,32
2030 FORI=1024TO1063:POKEI,28:POKEI+54272,3:POKEI+960,28:POKEI+55232,3:NEXT
2050 FOR I=1024 TO 1984 STEP 40
2060 POKE I,27:POKE I+54272,3:POKE I+39,27:POKE I+54311,3:NEXT
2090 FOR I=1 TO LE*4
2100 R=INT(RND(1)*1024)+1024:IFPEEK(R)=32THENPOKER,0:POKER+54272,7:GOTO 2120
2110 GOTO 2100
2120 NEXT
2130 PRINT"⌐££££££SCORE"SC"££££££LIVES"LI
2140 POKE 2023,58:POKE 1063,59:POKE 1984,60
2150 FOR I=0 TO LE
2160 POKEV+23,PEEK(V+23)OR2↑I:POKE2040+I,13:POKEV+39+I,5
2170 POKEV+2*I,RND(1)*231+24:POKEV+1+2*I,RND(1)*131+50:POKEV+21,PEEK(V+21)OR2↑I
2180 NEXT
2190 RETURN
4000 REM***********LEVELS***************
4030 POKE V+21,0:PRINT "⌐":LL=LL+.5:LE=LE+1:IF LE>7 THEN LE=7:LV=LV+1
4040 FF=(LE+LV)/5:F1=FF-INT(FF)
4050 IF F1=0 THEN LI=LI+1
4060 CO=INT(RND(1)*16):IFCO=15ORCO=0ORCO=3ORCO=5ORCO=7ORCO=13THEN 4060
4065 IFCO=1ORCO=8ORCO=14ORCO=10ORCO=4ORCO=12THEN 4060
4070 POKE 53280,CO:POKE 53281,CO
4080 L=1:H=1:T=2:P(0)=1440:P(1)=1441:P(2)=1442:S=1440:O=0:GOSUB 2000:GOTO 120
5000 REM*********HIGH SCORE*************
5010 POKE V+21,0
5030 PRINT"YOUR SCORE IS ";SC:IF SC<H(5) THEN 5500
5050 INPUT"YOUR NAME ";IN$:IF IN$=""OR LEN(IN$)>10 THEN PRINT"TTT":GOTO 5050
5060 H(5)=SC:H$(5)=IN$
5062 FOR I=1 TO 4
5064 IF H(I)=>H(I+1) THEN 5070
5065 P=H(I):H(I)=H(I+1):H(I+1)=P:P$=H$(I):H$(I)=H$(I+1):H$(I+1)=P$:V=1
5070 NEXT
5075 IF Y=1 THEN Y=0:GOTO 5062
5500 PRINT"⌐"TAB(10)"CURRENT TOP RATINGS":PRINTTAB(10)"------- --- -------"
5510 FORI=1TO5:PRINTTAB(7);"⌐"I,TAB(14);"⌐"H$(I),TAB(28),"⌐"H(I):PRINT"⌐":NEXT
5520 PRINT"⌐HIT A KEYTTTT":GET XX$:IF XX$="" THEN 5520
5530 GOTO 10
6000 REM*******TITLE PAGE***************
6030 PRINT"⌐ ••• • • ••• ••• ••• ••• ••• •••"
6040 PRINT"  • • • • •   •   •   • • •   • •"
6050 PRINT"  ••• • • • • ••  ••• ••• •   •••"
6060 PRINT"  • • • • • • •   •   • • •   • •"
6070 PRINT"  ••• ••• ••• ••• • • • • ••• • •"
6080 PRINT"⌐             ⌐HIT A KEY FOR INSTRUCTIONS"
6090 GET XX$:IF XX$="" THEN GOTO 6090
6100 PRINT"⌐"
6120 PRINT"    INTENT ON EATING YOUR WAY INTO      "
6130 PRINT"MANHOOD. YOU GO OUT ON  A MAD HUNT FOR  "
6140 PRINT"MUSHROOMS. ON YOUR JOURNEY  THOUGH YOU  "
6150 PRINT"FACE  MANY  HAZARDS. THE  YELLOW  WOLF  "
6160 PRINT"SPIDER HOLES,THE WALL AROUND YOUR PATCH "
6170 PRINT"AND FINALLY YOUR OWN EVER-GROWING TAIL. "
6180 PRINT"ALL POTENTIALLY DEADLY. ALSO CLUMPS OF  "
6190 PRINT"GRASS. NOT  HAZARDOUS  IN  THEMSELVES.  "
6200 PRINT"ARE IDEAL HIDING PLACES FOR SPIDER AND  "
6210 PRINT"MUSHROOMS.GOOD LUCK. AND MAY YOUR TAIL  "
6220 PRINT"         GROW EVER LONGER !!!"
6230 PRINT"⌐            ⌐HIT A KEY FOR GAME"
6240 GET XX$:IF XX$="" THEN GOTO 6240
6250 PRINT"⌐":RETURN
7000 AA=56320:B%=127:F%=1:G%=0:I%=32:J%=62:LL=2.5:C%=9:D%=7:H%=300:V%=10
7010 NN=54272:Q%=299:R%=1024:SS=0.8:T%=5:Z%=33
8000 REM***********SETUP*****************
8035 DEF FN F2(R)=((RAND4)=0)-((RAND8)=0)+(((RAND1)=0)*40)-(((RAND2)=0)*40)
8040 SC=10:L=1:H=1:T=2:P(0)=1440:P(1)=1441:S=1440:LE=1:LV=0:O=0:LL=2
8050 PRINT"⌐"
8055 B=119:LI=3:LE=1:CO=9:POKE 53280,CO:POKE 53281,CO:GOSUB 6000:GOSUB 2000
8085 POKE 54277,17:POKE 54278,32:POKE 54273,10:POKE 54272,60:POKE 54296,15
8110 RETURN
9000 REM**SET UP MACHINE CODE+SPRITES**
9010 FOR I=49160 TO 49179:READ D:POKE I,D:NEXT
9020 PRINTCHR$(142);CHR$(8):POKE 52,48:POKE 56,48:POKE 56334,PEEK(56334)AND254
9030 POKE 1,PEEK(1)AND251:FORI=0TO2048:POKEI+12288,PEEK(I+53248):NEXT
9040 POKE 1,PEEK(1)OR4:POKE 56334,PEEK(56334)OR1
9050 READ A:A=A*8:IF A=-8 THEN 9110
9060 FOR I=A TO A+7
9070 READ H:POKE I+12288,H
9080 NEXT
9090 POKE 53272,(PEEK(53272)AND240)+12
9100 GOTO 9050
9110 FOR I=832 TO 895:READ A:POKE I,A:NEXT
9120 V=53248:RETURN
10000 DATA169,13,162,0,157,0,216,157,0,217,157,0,218,157,0,219,232,208,241,96
10010 DATA62,60,126,255,231,24,24,24,24
10020 DATA126,128,184,124,124,92,94,109,57
10030 DATA125,1,29,62,62,46,110,182,156
10040 DATA119,96,16,124,254,222,238,124,3
10050 DATA123,192,62,127,111,115,62,0,3
10060 DATA118,110,159,63,95,94,68,38,2
10070 DATA122,118,249,252,250,122,54,92,64
10080 DATA117,2,57,124,126,125,61,159,110
10090 DATA121,64,156,190,126,254,236,153,118
10100 DATA27,95,191,95,191,95,191,95,191
10110 DATA28,255,255,255,255,255,85,170,85
10120 DATA58,255,255,255,255,255,170,85,152
10130 DATA59,255,255,255,255,255,191,95,191
10140 DATA60,191,95,191,95,191,85,170,85
10150 DATA61,63,191,95,191,95,191,95,191
10160 DATA0,0,24,126,251,231,126,24,0
10170 DATA-1
10180 DATA8,4,8,8,72,48,4,88,100,4,146,204,6,165,152,2,169,144,98,107,48,18,107
10190 DATA102,10,235,105,6,235,112,6,235,112,2,251,208,3,255,208,3,255,176,2
10200 DATA255,240,2,253,240,3,251,240,2,251,240,3,255,240,3,255,240,0,255,192,0
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FUNCTIONS

AND (bit-by-bit)
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DEC hexadecimal to decimal
DPEEK double PEEK
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MEM free memory
MEMORY$ all of memory as a string
MOD modules
NUMBER 2 characters to number
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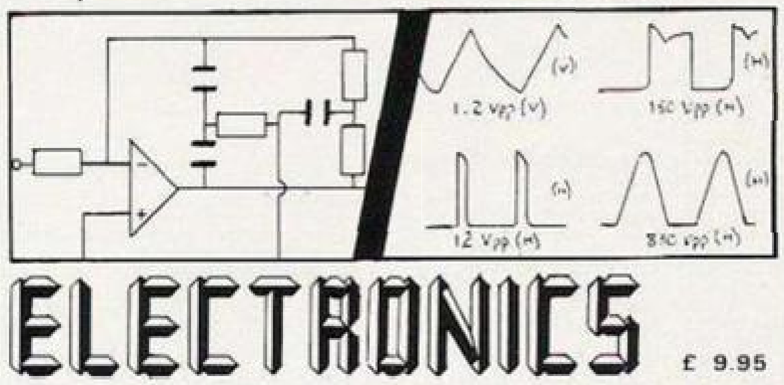

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(continued from page 185)

10200 DATA 255,240,3,255,240,3,255,240,
3,255,240,3,255,240,0,255,192,0

In order to minimise the number of Pokes I use a small piece of machine code which fills the colour screen before the main loop begins. The data for this piece of relocatable machine code is in line 10000 — check it before running. Between running the program and the title screen appearing is a short delay while the character set is redefined and the sprite data set up. You get a bonus life every five levels.

Graveyard-20

R W Silverside,
Whickham,
Newcastle upon Tyne.

THE AIM OF the game is to collect the sets of keys which are scattered around the graveyard. Every time you get all the sets of keys on the screen, the screen is reset with one more key.

As you move around the grid you destroy the squares which you step on, returning to one of these spaces will result in your destruction, as will stepping off the side of the grid. By pressing the space-bar the row which you are in is reprinted, and this can only be done if you have more than 200 points because it decreases your score by 200.

Destroys the bibles

This action also destroys all bibles in the row you are in. Every five screens cleared will result in another ghost appearing. The ghosts can reach a maximum of four. The skull and cross bones scattered everywhere must be avoided and if one of these is hit you will be destroyed. Also, all the sets of keys must be collected before 30 seconds have elapsed — the time is shown in middle of top line. If this is not achieved, you will again be destroyed.

Your score is in the top left-hand corner of the screen, and the number below this is the highest score. When the game ends, the opening screen is printed out again and the program runs again after about 10 seconds. Occasionally, when a new game should start, the program stops running and prints an error message. The program can be restarted by typing Run Stop-Restore and running the program again.

```
10 POKE36879,28:POKE36878,8:PRINT"⌐"
20 PRINTSPC(110)"■■■■■■■■■■■■GRAVEYARD-20■■■■■■■■
■■■"
30 PRINT"■BY R.W.SILVERSIDES"
40 PRINTSPC(76)"■Y■■G*H■■B"
50 PRINT"■TO RE-FILL A ROW PRESS          ■SPACE"
60 POKE51,255:POKE52,27:POKE55,255:POKE56,27
70 FORA=0TO511:POKE7168+A,PEEK(32768+A):NEXT
80 FORA=0TO111:READAA:POKE7168+A,AA:NEXT
90 DATA0,60,60,126,36,36,24,255,189,189,189,60,36,36,36,102
100 DATA0,0,0,24,60,126,90,126,126,126,126,126,84,84,0,0
110 DATA0,0,0,0,24,60,90,126,36,24,66,231,24,24,231,66
120 DATA0,0,0,62,62,62,54,34,54,54,62,62,62,0,0,0
130 DATA0,0,60,102,60,24,24,24,24,24,24,30,28,30,24,24
140 DATA128,126,126,126,126,126,126,126,126,126,126,126,126,126,126,128
150 DATA0,0,24,24,24,255,255,24,24,24,24,24,36,66,129,255
160 PRINT"∟":POKE36869,255
170 FORZ=0TO4:READBB(Z):NEXT
180 DATA1,1,16,8,1
190 DA=BB(4):POKE36879,156
200 FORA=0TO9:FORAA=1TO20:POKE7724+A*44+AA,10:POKE7746+A*44+AA,11
210 POKE38444+A*44+AA,5:POKE38466+A*44+AA,5:NEXTAA:NEXTA
220 FORB=0TO4:FORC=1TOBB(B)
230 DD=(INT(RND(1)*10)*44)+(INT(RND(1)*20)+7725)
240 IFB=1THENS(C)=DD
250 IFB=0THENM=DD
260 IFPEEK(DD)<>10THEN230
270 Z=1:IFB=2THENZ=6
280 IFB=3THENZ=2
290 POKEDD,B*2:POKEDD+22,B*2+1
300 POKEDD+30720,Z:POKEDD+30742,Z:NEXTC:NEXTB
310 TI$="000000"
320 PRINT"■■"SC,RIGHT$(TI$,2),HS
330 MA=M:MA=MA+(PEEK(197)=19)-(PEEK(197)=43)-44*(PEEK(197)=35)+44*(PEEK(197)=11)
340 IFMA<7724ORMA>8141THENMA=M:GOTO410
350 IFPEEK(MA)=32ORPEEK(MA)=2ORPEEK(MA)=4THEN500
360 IFPEEK(MA)=10THENSC=SC+10:POKE36876,150
370 IFPEEK(MA)=6THENSC=SC+100:POKE36876,250
380 IFPEEK(MA)=8THENSC=SC+200:POKE36876,DA+200:DA=DA-1:IFDA=0THEN620
390 POKEM,32:POKEM+22,32:M=MA:POKEM,0:POKEM+22,1:POKEM+30720,0:POKEM+30742,0
400 IFPEEK(197)=32THENGOSUB550
410 :POKE36876,0:FORC=1TOBB(1)
420 EE=INT(RND(1)*4)
430 SA=S(C):SA=SA+(EE=0)-(EE=1)+44*(EE=2)-44*(EE=3)
440 IFPEEK(SA)<>10ANDPEEK(SA)<>0THEN470
450 IFPEEK(SA)=0THENGOSUB660:GOTO500
460 GOSUB660
470 NEXT
480 IFTI$>"000030"THEN500
490 GOTO320
500 POKEM,32:POKEM+22,32:M=MA:POKEM,12:POKEM+22,13
510 FORMU=255TO128STEP-1:POKE36877,MU:NEXT:POKE36877,0
520 RESTORE
530 FORT=1TO2500:NEXT:IFSC>HSTHENHS=SC
540 SC=0:POKE36869,240:GOTO10
550 IFSC<200THENRETURN
560 SC=SC-200
570 H=INT((M-7724)/44)*44+7724:FORHA=1TO20:HB=PEEK(H+HA):IFHB=32ORHB=6THENHB=10
580 POKEH+HA,HB:POKEH+HA+22,HB+1
590 HC=5:IFHB=4THENHC=6
600 IFHB=8THENHC=1
610 POKEH+HA+30720,HC:POKEH+HA+30742,HC:NEXTHA:RETURN
620 POKEM,32:POKEM+22,32:M=MA:POKEM,0:POKEM+22,1:BB(4)=BB(4)+1:BB(1)=INT(BB(4)/5
)+1
630 FORMU=128TO255:POKE36876,MU:NEXT:POKE36876,0
640 FORT=1TO2000:NEXT:TI$="000000":IFBB(4)=21THEN680
650 GOTO190
660 POKES(C),10:POKES(C)+22,11:POKES(C)+30720,5:POKES(C)+30742,5
670 S(C)=SA:POKES(C),2:POKES(C)+22,3:POKES(C)+30720,1:POKES(C)+30742,1:RETURN
680 POKE36869,240
690 PRINT"⌐⌐WELL DONE YOU HAVE    SAVED THE GRAVEMAN    FROM THE HORRORS OF ";
700 PRINT"  THE GRAVEYARD":PRINT"YOUR SCORE WAS"SC
710 PRINT"DO YOU WANT ANOTHER GO  (Y/N)":INPUTA$
720 IFA$="Y"THENRUN
```

Light Bikes

R Pearmain,
Grimsby,
South Humberside.

LIGHT BIKES is a game for the Amstrad CPC-464. The game is for two players in which each player must kill off the opponent. Full instructions are in the program. The keys used are:

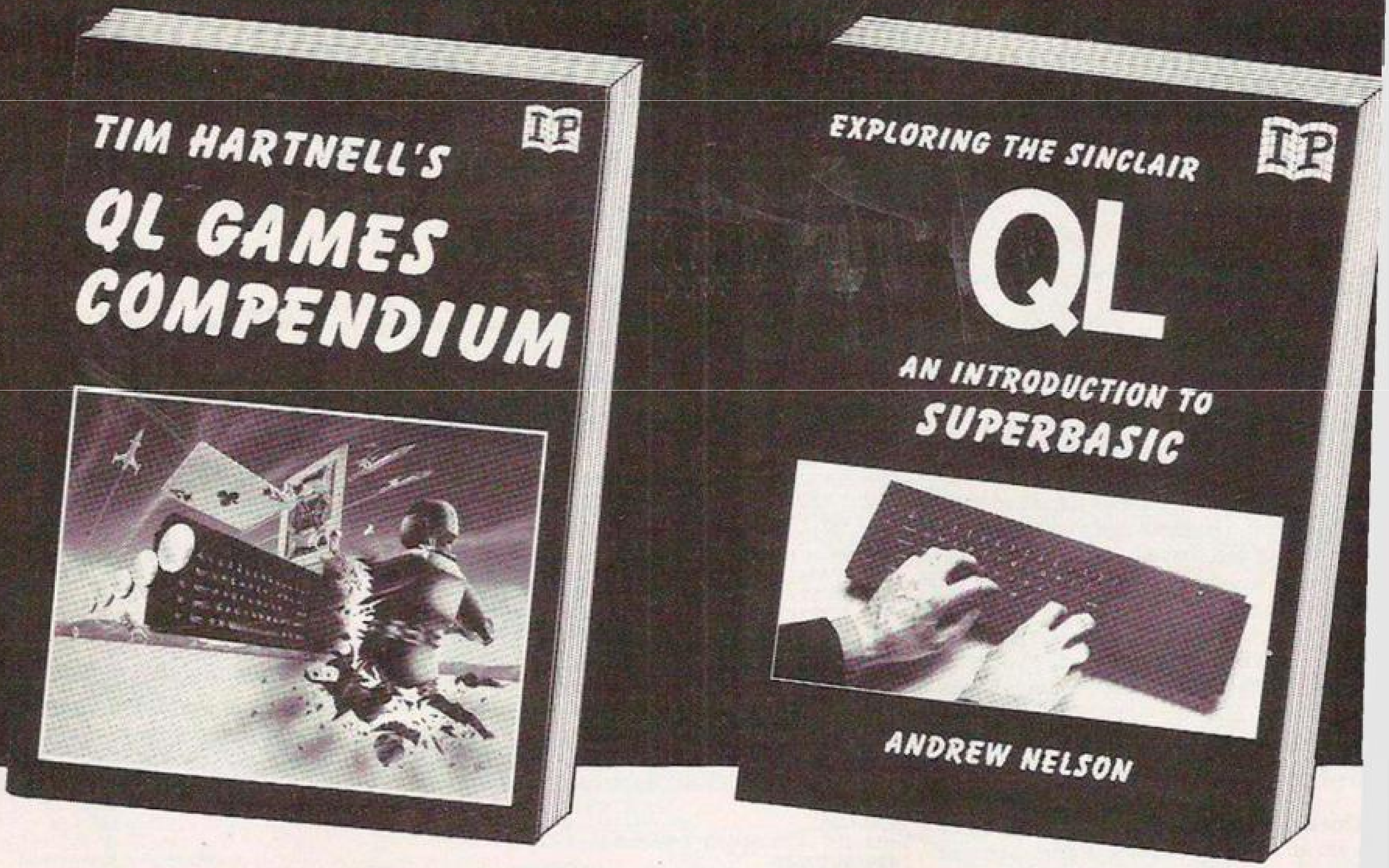
Player 1	Player 2
Up W	Up :
Left A	Left *
Right S	Right +
Down Z	Down ?

There is also a time limit, and a tune built into the program.

```
10 ON BREAK GOSUB 930
20 v=3
30 REM ****LIGHT BIKES****
40 REM **COPYRIGHT  1984**
50 REM ***R.L.PEARMAIN ***
60 REM
70 MODE 1
80 INK 0,0
90 CLS
100 INK 2,0
110 PEN 2
120 CLS
130 GOSUB 640
140 CLS
150 MODE 0
160 INK 4,13
170 INK 2,20:INK 3,6
180 INK 1,10,20
190 ti=499
200 a=24:b=319:c=350:d=319
210 e=1:f=0:g=-1:h=0
220 REM set up screen
230 LOCATE 1,1:PEN 2:PRINT"Time left-"
240 PEN 1:PLOT 0,382,1:DRAW 639,382,1:DRAW 639,0,1:DRA
W 0,0,1:DRAW 0,382,1
250 FOR n=79 TO 559 STEP 80:PLOT n,382,4:DRAW n,0,4:NE
XT n
```

(continued on page 191)

TWO GREATS FOR THE SINCLAIR QL



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(continued from page 189)

```
260 FOR n=70 TO 382 STEP 80:PLOT 0,n,4:DRAW 638,n,4:NE
XT n
270 REM ***start game***
280 PLOT b,a,2:PLOT d,c,3
281 SOUND 1,2500,10,3,0,0,1:SOUND 2,2400,10,3,0,0,1
290 REM ***check player one***
300 IF INKEY(59)=0 THEN e=1:f=0
310 IF INKEY(71)=0 THEN e=-1:f=0
320 IF INKEY(60)=0 THEN e=0:f=1
330 IF INKEY(69)=0 THEN e=0:f=-1
360 REM ***check player one***
370 IF INKEY(26)=0 THEN g=1:h=0
380 IF INKEY(30)=0 THEN g=-1:h=0
390 IF INKEY(28)=0 THEN g=0:h=1
400 IF INKEY(29)=0 THEN g=0:h=-1
410 a=a+2*e:b=b+4*f:c=c+2*g:d=d+4*h
420 REM ***check crashes***
430 ti=ti-1:IF ti=0 THEN GOSUB 520
440 LOCATE 10,1:PRINT ti
450 x=TEST (b,a)
460 y=TEST (d,c)
470 IF x=4 OR y=4 THEN 510
480 IF x<>0 AND y<>0 THEN 520
490 IF x<>0 THEN 550
500 IF y<>0 THEN 590
510 GOTO 280
520 GOSUB 620
530 MODE 1:PRINT "Hard luck contestants.You both crash
ed!"
540 GOTO 830
550 GOSUB 620
560 MODE 1:PRINT "Well done Red bike."
570 PRINT "May the blue rider rest in peace."
580 GOTO 830
590 GOSUB 620:MODE 1:PRINT "Well done Blue bike."

600 PRINT "May the Red Rider rest in peace."
610 GOTO 830
620 DI:CLS:SOUND 1,1000,50,15,0,0,1:SOUND 2,2000,50,15
,0,0,1:FOR n=1 TO 100:NEXT:EI
630 RETURN
640 REM ***INSTRUCTIONS***
650 PRINT TAB (15);"LIGHT BIKES"
660 INK 2,2,10
670 SPEED INK 50,50
680 INK 3,0
690 PEN 3
700 RESTORE 890:PRINT:PRINT"Welcome contestants to the
 most deadly  "
710 PRINT"game of all time.Each of you will be in "
720 PRINT"control of a light bike.One will be of   "
730 PRINT"the colour blue (beta class 7 model),    "
740 PRINT"and the other will be of the colour red "
750 PRINT"(zepha class 15 model).Your objective is"
760 PRINT"to kill of the opponent by trapping him "
770 PRINT"with your laser traces.Good luck,you'll "
780 PRINT"need it!!!"
790 INK 3,15
800 LOCATE 10,24:PEN 2:PRINT "Press any key to play":P
EN 3
810 IF INKEY$="" THEN GOSUB 860:GOTO 810
820 RETURN
830 IF INKEY$<>" " THEN 830
840 SOUND 1,100,50:SOUND 2,90,50:SOUND 4,110,50
850 GOTO 70
860 READ note:IF note=0 THEN RESTORE 890:v=3
870 SOUND 1,note,50,v:SOUND 2,note+2,50,v:SOUND 4,note
+4,50,v
880 RETURN
890 DATA 716,758,851,956
900 DATA 716,758,851,956
910 DATA 716,758,851,956
920 DATA 478,478,478,0
930 GOTO 60
```

Alien Wars

A Smith,
Luton,
Bedfordshire.

ALIEN WARS is a shoot-'em-up game using player/missile graphics. Aliens come straight down the screen or zig-zag bouncing off the sides. They also drop bombs. You must shoot them before they reach the bottom of the screen or the Aliens are safe. If 20 aliens survive, the game is over. You also have five lives and colliding with an alien or a bomb loses a life.

The data lines in the program are a machine-code routine so the program should be CSaved before running.

```
10 REM **** ALIEN WARS ****
20 REM **** ATARI BASIC ***
30 REM **** BY A.SMITH ****
40 REM **** 20/4/84 *******
100 T=1:HISCORE=100:GRAPHICS 6
110 GUN=102:F=0:SA=0:LV=5:SCORE=0
140 GOSUB 10085
150 POKE 53278,2
180 IF T THEN T=0:GOSUB 10000:GOSUB 30000
200 GOSUB 20000
220 GOSUB 9000:GOSUB 9500
500 REM **** MAIN LOOP ****
1000 IF VP>180 THEN GOSUB 9000:SA=SA+1:POKE 656,2:POKE 657,37:? SA
1005 IF UP>180 THEN GOSUB 9500:SA=SA+1:POKE 656,2:POKE 657,37:? SA
1030 VP=VP+VM:HP=HP+HM:POKE 1782,VP:POKE 1781,UP
1040 XP=XP+XM:UP=UP+UM:POKE 53250,XP:POKE 53249,HP
1070 IF XP>190 OR XP<51 THEN XM=-XM
1090 SOUND 2,VP,10,6
1170 IF HP>190 OR HP<51 THEN HM=-HM
1180 IF PEEK(53260)>0 THEN POKE 1781,40:POKE 1782,40:UP=40:VP=40:GOSUB 5000
1190 SOUND 1,UP,10,6
2000 ST=STICK(0)
2010 IF ST=15 THEN 2040
2020 IF ST=11 THEN IF GUN>52 THEN GUN=GUN-3:POKE 53248,GUN
2030 IF ST=7 THEN IF GUN<196 THEN GUN=GUN+3:POKE 53248,GUN
2040 IF F THEN GOSUB 3000:GOTO 2200
2050 IF STRIG(0)=0 THEN F=1:POKE 53251,GUN:MSL=170:POKE 1783,MSL:VOL=16
2200 LBM=BM2:BM2=BM2+4:LB=BM1:BM1=BM1+4:COLOR 1:PLOT BX2,BM2:PLOT BX1,BM1:COLOR
0:PLOT BX2,LBM:PLOT BX1,LB
2300 IF BM2>79 THEN COLOR 0:PLOT BX2,BM2:BM2=VP/2-15:BX2=XP-40:IF PEEK(53252)=1
THEN GOSUB 5000
2500 IF BM1>79 THEN COLOR 0:PLOT BX1,BM1:BM1=UP/2-15:BX1=HP-40:IF PEEK(53252)=1
THEN GOSUB 5000
2600 GOTO 1000
2999 REM **** MOVE MISSILE ****
3000 MSL=MSL-8:VOL=VOL-1:POKE 1783,MSL
3010 SOUND 0,50-VOL,0,VOL
3030 IF MSL<50 THEN F=0:POKE 53251,0:SOUND 0,0,0,0
3050 IF PEEK(53263)=0 THEN RETURN
3060 F=0:POKE 53251,0
3070 W=PEEK(53263)
3075 COLOR 0
3078 PLOT BX1,BM1:PLOT BX2,BM2
3080 IF W=2 THEN BN=INT(UP/20)*10:GOSUB 9500
3090 IF W=4 THEN BN=INT(VP/20)*10:GOSUB 9000
3095 SCORE=SCORE+BN:POKE 656,1:POKE 657,11:? SCORE
3100 POKE 53278,5
3200 FOR GBH=1 TO 200 STEP 10:POKE 712,52:SOUND 0,GBH,12,15:POKE 712,234:NEXT GB
H
3220 POKE 712,0
3400 SOUND 0,0,0,0
3500 RETURN
5000 REM **** GUN EXPLODES ****
5005 POKE 53278,2
5008 SOUND 1,0,0,0:SOUND 2,0,0,0
5010 LV=LV-1:POKE 656,1:POKE 657,37:? LV
5020 FOR GBH=200 TO 20 STEP -40
5030 FOR N=GBH-10 TO GBH+10
5040 SOUND 0,N,8,15
5045 POKE 704,PEEK(20)
5050 NEXT N:NEXT GBH
5060 SOUND 0,0,0,0
5070 POKE 704,230
5075 COLOR 0:PLOT BX1,BM1:PLOT BX2,BM2
5080 GOSUB 9000:GOSUB 9500
5090 IF LV=0 THEN GOTO 6000
5100 RETURN
6000 REM **** GAME OVER ****
6010 POKE 656,3:? "         G A M E  O V E R";
6020 IF SCORE>=HISCORE THEN HISCORE=SCORE:POKE 656,2:POKE 657,11:? HISCORE
6030 SOUND 1,255,10,8:SOUND 2,254,10,8:SOUND 0,0,0,0
6040 COLOR 0
6050 PLOT BX1,BM1:PLOT BX2,BM2
6060 FOR D=0 TO 200:NEXT D
6070 IF STRIG(0)=1 THEN 6070
6080 GOTO 110
8000 REM **** ANGLES FOR ALIENS ****
8010 IF SA>19 THEN GOTO 6000
8030 N=INT(RND(0)*130+54)
8040 D=INT(RND(0)*3)
8050 IF D=0 THEN M=-6
8060 IF D=1 THEN M=6
8070 IF D=2 THEN M=0
8080 A=INT(RND(0)*3)+3
8090 COLOR 0:PLOT BX2,BM2:PLOT BX1,BM1
8095 POKE 53278,2
8100 RETURN
9000 REM **** ANGLES FOR ALIENS ****
9010 GOSUB 8000
9020 XP=N:XM=M:VM=A:VP=36
9150 BM2=VP/2-15:BX2=XP-40
9160 POKE 706,(INT(RND(0)*15+1)*16)+10
9200 RETURN
9500 REM **** ANGLES FOR ALIENS ****
9520 GOSUB 8000
9530 HP=N:HM=M:UM=A:UP=36
9650 BM1=UP/2-15:BX1=HP-40
9660 POKE 705,(INT(RND(0)*15+1)*16)+10
9700 RETURN
10000 REM **** BACKGROUND ****
10010 COLOR 1
10020 SETCOLOR 2,0,0
10030 PLOT 0,79:DRAWTO 0,0
10040 DRAWTO 159,0:DRAWTO 159,79
10050 RETURN
10085 ? CHR$(125):POKE 752,1
10090 POKE 656,1:POKE 657,0:? "SCORE     : ";SCORE;:POKE 657,23:? "LIVES
";LV
10100 POKE 656,2:POKE 657,0:? "HI SCORE  : ";HISCORE;:POKE 657,23:? "SAFE ALIENS
: ";SA
10200 RETURN
20000 REM **** PM COLOURS ****
20010 POKE 704,222:POKE 707,14
20020 POKE 1780,176
20030 POKE 53248,GUN
20050 POKE 53257,1:POKE 53258,1
21050 RETURN
30000 REM **** PM VERT POSITIONING **
30010 FOR I=1536 TO 1706:READ A:POKE I,A:NEXT I
30020 FOR I=1774 TO 1787:POKE I,0:NEXT I
30030 PM=PEEK(106)-32:P=256*PM
30040 FOR I=P+1024 TO P+2048:POKE I,0:NEXT I
30050 RESTORE 31400:FOR I=P+1025 TO P+1034:READ A:POKE I,A:NEXT I:POKE 1784,10
30060 RESTORE 31200:FOR I=P+1281 TO P+1290:READ A:POKE I,A:NEXT I:POKE 1785,10
30070 RESTORE 31200:FOR I=P+1537 TO P+1546:READ A:POKE I,A:NEXT I:POKE 1786,10
30080 RESTORE 31300:FOR I=P+1793 TO P+1800:READ A:POKE I,A:NEXT I:POKE 1787,10
30090 POKE 559,62:POKE 623,1:POKE 1788,PM+4:POKE 53277,3:POKE 54279,PM:X=USR(169
6):RETURN
31010 DATA 162,3,189,244,6,240,89,56,221,240,6,240,83,141,254,6,106,141
```

(continued on next page)

(continued from previous page)

```
31020 DATA 255,6,142,253,6,24,169,0,109,253,6,24,109,252,6,133,204,133
31030 DATA 206,189,240,6,133,203,173,254,6,133,205,189,248,6,170,232,46,253
31040 DATA 6,144,16,168,177,203,145,205,169,0,145,203,136,202,208,244,76,87
31050 DATA 6,160,0,177,203,145,205,169,0,145,203,200,202,208,244,174,253,6
31060 DATA 173,254,6,157,240,6,189,236,6,240,48,133,203,24,138,141,253,6
31070 DATA 109,253,6,133,204,24,173,253,6,109,252,6,133,206,189,240,6,133
31080 DATA 205,189,248,6,170,160,0,177,203,145,205,200,202,208,248,174,253,6
31090 DATA 169,0,157,236,6,202,48,3,76,2,6,76,98,228,0,0,104,169
31100 DATA 7,162,6,160,0,32,92,228,96
31200 DATA 129,153,189,189,219,255,255,189,165,165
31300 DATA 0,36,36,36,36,36,0,0
31400 DATA 36,36,60,60,126,126,255,24,60,126
```

Shade Copy

I J Abbott,
Doncaster,
South Yorkshire.

SPECTRUM

SHADE COPY IS a routine for the 16/48K Spectrum connected to a Sinclair ZX or Alphacom 32 printer. It has two advantages over the Spectrum Copy command. First, it allows you to copy all — including the bottom two lines — or any part of the screen. Secondly, it provides three modes of operation, namely normal, inverse and shaded copy.

Instead of transferring ink or paper dots from the screen to the printer, the shading routine looks at the affecting Ink and Paper attributes — not the Bright or Flash attributes — and converts the dots into one of eight shading patterns corresponding to their colours before sending to the printer.

The parameters for the routine are specified in the same command as the USR call rather than being Poked in separately. The routine can be activated by a command such as: Randomise mode Or first And depth <>USR copy where Mode, First and Depth are numeric expressions and Copy is the address of the routine. Randomise whould be replaced by "Let dummy=" if your program uses the RND function.

The syntax of the command may be distinctly meaningless, but as far as the Spectrum is concerned, it is a perfectly valid expression and gets through the syntax check satisfactorily. If the sub-expressions Mode, First or Depth contain any comparison or logical operators then they may need to be enclosed in parentheses.

Since the operators Or, And and <> are in increasing order of priority, the value of Mode, First and Depth have been placed on the calculator stack by the time the USR Copy is reached.

The routine reads these values off the calculator stack. Mode can take the following values:

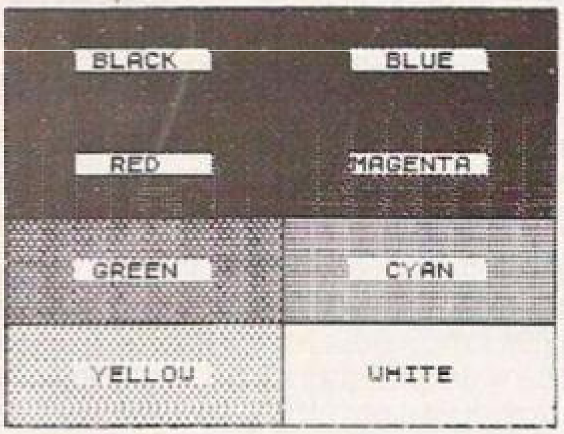
0 : normal mode
1 : inverse mode
2 : shaded mode

First can take values in the range 0 to 191 and specifies the first line of pixels to be handled, zero being top line of the display. Depth specifies the number of pixel lines to be handled.

To get the routine into the machine, type in the longer-than-average hex loader program which is fairly fool-proof and quite fun to use — as hex loaders go — and should speed up the task of entering the data. Alternatively, a shorter loader program could be used. If you typed it in, save it as it may be useful for entering other hex dumps in the same fairly common format.

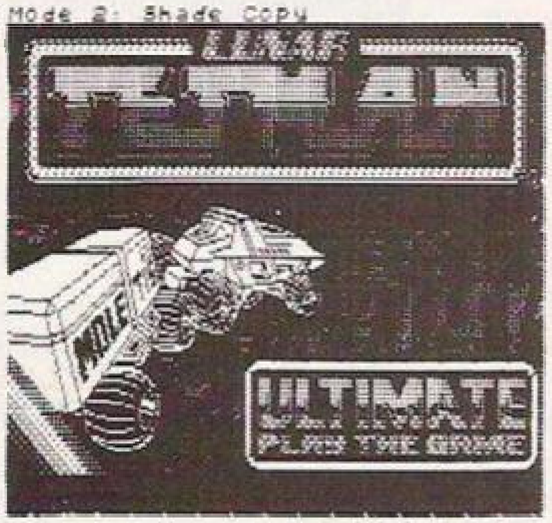
Now run the loader program and enter the hex and the checksums. The program will then save the code so have a tape ready. Although the code was entered at address 32289 — for the benefit of 16K owners; how come you bought a printer before a RAM expansion? — in fact the code is fully relocatable and will load and work at any address above RAMtop — 48K owners breathe a sigh of relief. The routine is 311 bytes long and uses the printer buffer as a work area.

The colour demo program shows the shading patterns used to represent colours and the screen$demo program dumps a screen$ file in each mode for comparison.



Mode 0: Normal

Mode 2: Shade Copy



COLOUR DEMO PROGRAM>

```
  10 INK 0: PAPER 7: BRIGHT 0: F
LASH 0: CLEAR 32288: OVER 0: INV
ERSE 0: RESTORE
  20 LET COPY=32289: PRINT "LOAD
 SHADE COPY": LOAD "SHADE COPY"C
ODE COPY: CLS
  30 FOR C=0 TO 6 STEP 2
  40 FOR I=1 TO 5
  50 PRINT PAPER C, PAPER C+1,
  60 NEXT I
  65 PLOT 0,175-20*C: DRAW 255,0
  70 NEXT C
  75 PLOT 0,175: DRAW 0,-159: DR
AW 255,0: DRAW 0,159: PLOT 128,1
6: DRAW 0,159
  80 FOR I=2 TO 17 STEP 5
  90 READ A$
 100 PRINT AT I,4;A$
 110 READ A$
 120 PRINT AT I,20;A$
 130 NEXT I
 140 DATA " BLACK  "," BLUE  ",
"  RED   ","MAGENTA "," GREEN  "
,"  CYAN  "," YELLOW "," WHITE  
"
 150 RANDOMIZE 2 OR 0 AND 160<>U
SR COPY
```

SCREEN$ DEMO PROGRAM>

```
  10 CLEAR 32298
  20 LET copy=32299
  30 LOAD "SHADE COPY"CODE copy
  40 LOAD ""SCREEN$
  50 LPRINT '"Mode 0: Normal"'
  60 RANDOMIZE 0 OR 0 AND 192<>U
SR copy
  70 LPRINT '"Mode 1: Inverse"'
  80 RANDOMIZE 1 OR 0 AND 192<>U
SR copy
  90 LPRINT '"Mode 2: Shade Cop
y"'
 100 RANDOMIZE 2 OR 0 AND 192<>U
SR copy
```

HEX LOADER PROGRAM>

```
  10 INVERSE 0: CLEAR 32288
  20 PRINT AT 21,0;
  30 LET start=32289
  40 LET length=311
  50 LET end=start+length
  60 LET o$=""
  70 LET n=start
  80 POKE 23692,255: PRINT n;"
 ";
  90 LET d=0: LET m=n: LET t=0
 100 IF m=end THEN GO TO 2000
 110 GO SUB 1000: LET b=16*h
 120 GO SUB 1000: LET b=b+h
 130 POKE m,b: LET t=t+b: LET m=
m+1: LET d=d+1
 140 IF d<>8 AND m<>end THEN GO
TO 110
 150 INPUT "Checksum:";cs
 160 IF cs=t THEN PRINT " = ";cs
: LET n=m: GO TO 80
 170 PRINT #0; FLASH 1;"CHECKSUM
 WRONG. RE-ENTER LINE"
 180 BEEP 1,-20: LET l=24-PEEK 2
3689: PRINT AT l,8,,AT l,8;: INP
UT ;: GO TO 90
1000 POKE 23658,8
1010 LET n$=INKEY$: IF n$=o$ THE
N GO TO 1010
1020 LET o$=n$: LET k=CODE n$: I
F k<32 OR k>96 THEN GO TO 1010
1030 IF k<48 THEN GO TO 1080
1040 IF k<58 THEN LET h=k-48: GO
 TO 1070
1050 IF k<65 OR k>70 THEN GO TO
1080
1060 LET h=k-55
1070 PRINT n$;: BEEP .01,10: RET
URN
1080 PRINT INVERSE 1;n$;CHR$ 8;:
 BEEP .5,-10: GO TO 1010
2000 CLS : PRINT "O.K. Saving as
:-"'"SAVE ""SHADE COPY""CODE ";s
tart;",";length
2010 PAUSE 1: PAUSE 50
2020 SAVE "SHADE COPY"CODE start
,length
```

HEX DATA>

```
32289 : 2A635C010F0009ED = 495
```

(continued on page 197)

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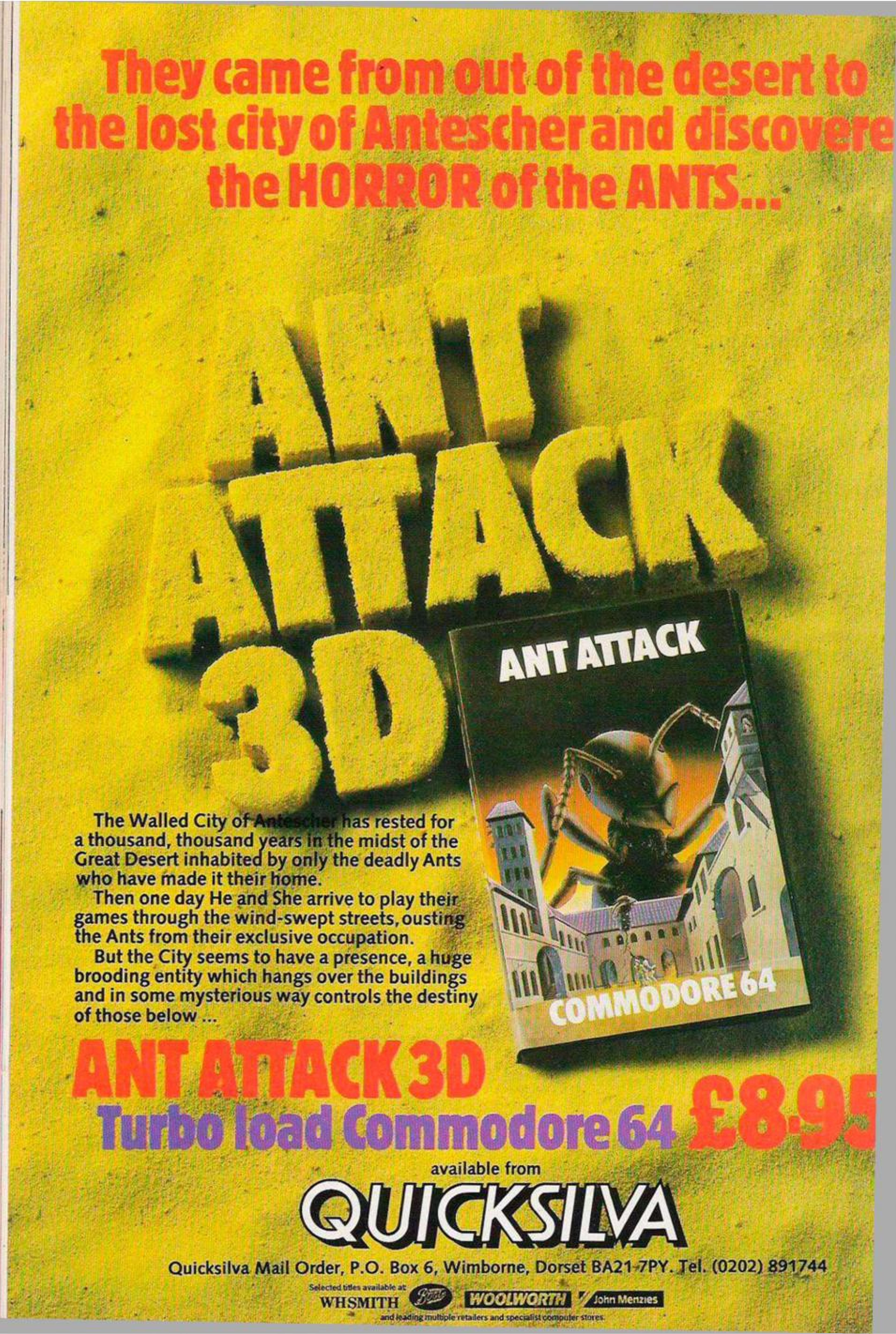
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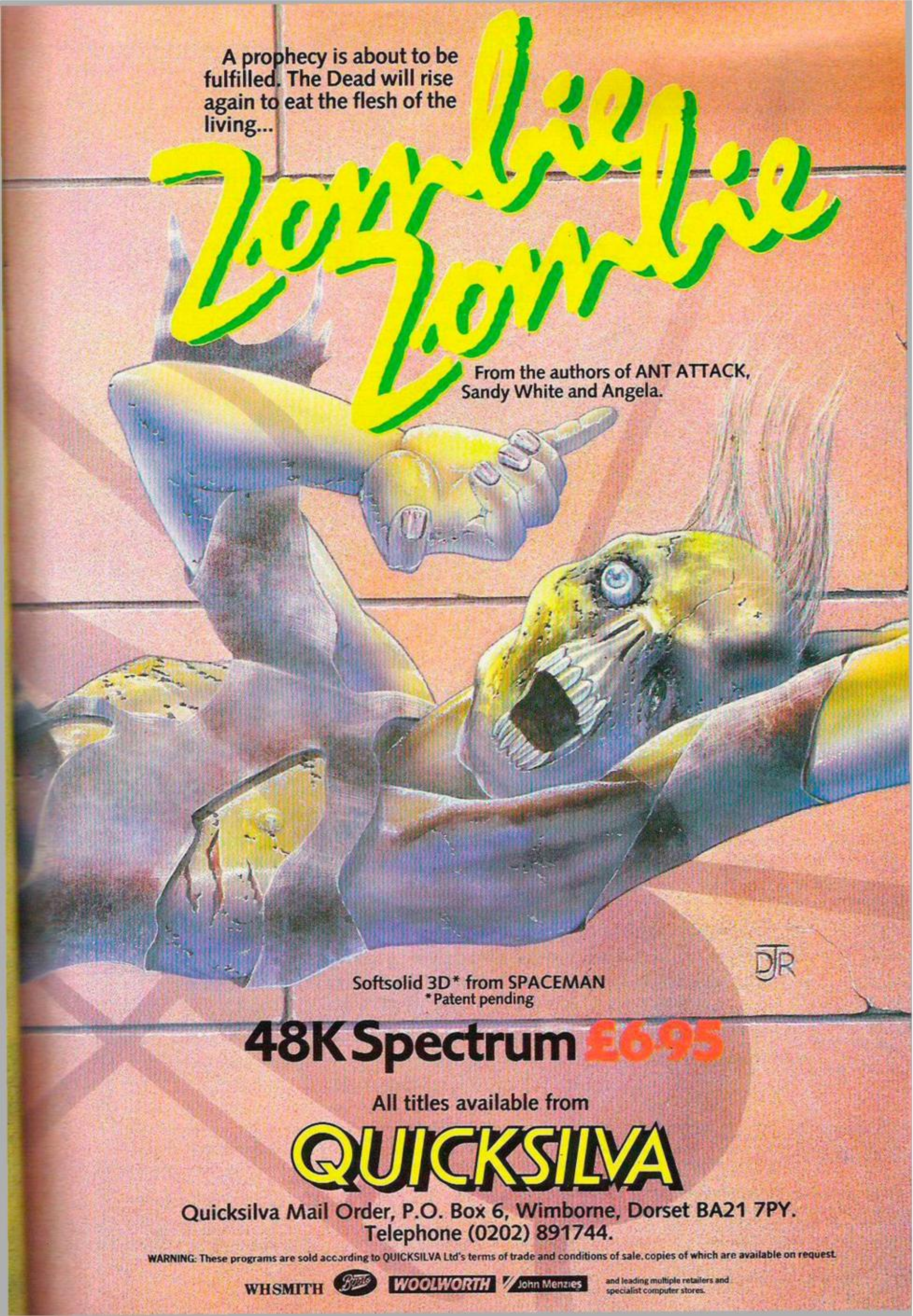

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(continued from page 192)

```
32297 : 5B655CB7ED52D5C2 = 1193
32305 : 8B28CDA22D78B728 = 934
32313 : 03FBCF0AC5CDA22D = 1080
32321 : FEC030F578B720F1 = 1315
32329 : 414FC578CDB122E3 = 1104
32337 : 7C070767E6E06F7C = 930
32345 : E603F65867E5CDA2 = 1266
32353 : 2DFE0330D40878B7 = 873
32361 : 20CFD1E1C1E32265 = 1228
32369 : 5CE14180CADA0EF3 = 1235
32377 : 7AFE5B288C3E04D3 = 972
32385 : FBDD21205BEBC5D5 = 1273
32393 : E50101207985 77E20 = 725
32401 : 030F0F0FE60711FF = 557
32409 : FF284D3D1EDD2848 = 796
32417 : 3D1E5528433D16EE = 604
32425 : 283E3D1144AA2838 = 514
32433 : 3D1E0028333D1688 = 401
32441 : 282E53182B21005B = 360
32449 : C1C53E0890E60F47 = 920
32457 : CDF40EE1C1D1247C = 1250
32465 : E60728051028C3DA = 751
32473 : 0E7DC6206F3F9FE6 = 932
32481 : F884671093C3DA0E = 1073
32489 : DD7200DD7340DD23 = 991
32497 : 2310990D20050620 = 292
32505 : E11891D1EBC1D5C5 = 1441
32513 : E501200011005BED = 607
32521 : B0084F083E019138 = 535
32529 : 11280218A821005B = 375
32537 : 06207E2F772310FA = 631
32545 : 189BC1C5DD21205B = 946
32553 : CB402804DD21605B = 752
32561 : 21005B480620DD56 = 541
32569 : 00DD5E20CB492808 = 671
32577 : CB0ACB0ACB0BCB0B = 854
32585 : 7EA2577E2FA3B277 = 1008
32593 : 23DD2310E118BC = 744
```

New commands

B D Parsons,
Saughall,
Chester.

VIC-20

THE PROGRAM is a Basic enhancement program which adds new commands to Vic Basic. It is designed to enable users to add their own commands easily following a few simple rules.

The program may be used with any memory configuration and calculates the amount of memory it requires, lowering the "top of memory" pointers accordingly. The machine-code program is then Poked into memory and the Basic program News itself, leaving the New commands ready to be used from within any program typed or loaded into the computer. The new commands may not be used in the direct mode.

Five extra commands are shown included with the program as examples.

Within the Basic program using the new commands, each command must be prefixed with a.

e.g. — @PLOT, @SOUND, etc.

Below is the syntax for each of the exampl commands shown. Please note the comma: are essential.

- @PLOT,X,Y,"STATEMENT" will prin "statement" at character position X alon line number Y down from top of screen.
- @COLOUR,BO,SC,AUX will set the Vi colours as below:

BO:—value 0-7 sets border colour
SC:—value 0-15 sets screen colour
AUX:—value 0-15 sets auxiliary colour — used in multicolour mode.

- @DOKE,ADD,NO. will poke a double-byte number i.e., 0-65536 into a two-byte address.
- @SOUND,VOICE,VALUE will cause the voice chosen — 1 to 41 — to sound a note chosen by value — 128 to 255 — see Vic Computer Guide page 135 for value.

The note will continue until a value of less than 128 is chosen or until the volume is turned off — see below. To turn off all sound use the following:

@SOUND,0

- @VOLUME,VALUE will set the volume of sound played. Where value is in range — 0-off to 15-maximum.

Machine-code programs supporting commands must be relocatable i.e., they must work when poked into any memory location.

The name of the command must be the first data statement, being a maximum of eight letters and a minimum of four — note only the first four letters are checked so don't use any commands with the same first four letters.

Each machine-code routine must end with — JMP £0079 i.e., DATA 76,121,0,−1. The −1 being used by the Basic wedge program to detect the end of the routine.

Program breakdown.

LINES 50-90 Calculate approximately how many bytes are required by the machine-code routines, lower top of memory pointers accordingly and calculate start address.

LINES 100-160 Poke M/C wedge program into memory from start address.

LINES 140-160 Modify M/C program according to start address.

LINES 180-190 Set up pointers in zero page for command list and start address.

LINES 200-280 Read the command names and place these in a list starting at address 737, then poke the routine into memory following the wedge program. Also calculate the number of commands and store.

LINES 290-310 Run the wedge program and New the Basic program. The number shown on the screen is the top of memory pointer + 1.

LINES 320-440 Contain the M/C wedge program.

LINES 1000-1210 Contain sample Basic extension routines. To enter extra commands place your own routines after line 1210 and before line 1990.

Vic commands.

```
10 PRINT"J WVIC BASIC EXTENSION"
20 PRINT"M   B.PARSONS. 1984"
30 PRINT"MMMPLEASE WAIT...WORKING
40 REM****************
50 REM RESET MEMTOP  .
60 XX=0
70 READA$:IFA$<>"END"THENXX=XX+1:GOTO70
80 RESTORE
90 A=PEEK(55)+256*PEEK(56):A=A-XX:POKE55,A AND255:POKE56,A/256:C=A+1:I=C:TL=0
100 REM****************
110 REM LOAD BASIC WEDGE
120 READD:IFD<>-1THENPOKEI,D:I=I+1:TL=TL+D:GOTO120
130 IFTL<>13892THENPRINT"DATA INCORRECT. CHECK LINES 330 TO 440":STOP
140 POKEC+7,(C+15)AND255:POKEC+8,(C+15)/256
150 POKEC+16,(C+21)AND255:POKEC+17,(C+21)/256
160 POKEC+19,(C+28)AND255:POKEC+20,(C+28)/256
170 REM****************
180 REM SET UP CMD LIST/JMP ADDRESSES
190 POKE 251,177:POKE 252,2:POKE 253,225:POKE 254,2
200 REM****************
210 REM READ CMD.POKE ROUTINE INTO MEMORY
220 Z=0
230 READ A$:IFA$="END"THEN 280
240 FORB=1TO4:POKE 688+Z*4+B,ASC(MID$(A$,B,1)):NEXT
250 POKE 737+Z*2,I AND 255:POKE 738+Z*2,I/256:Z=Z+1
260 READA:IFA<>-1THEN POKE I,A:I=I+1:GOTO260
270 GOTO230
280 POKE 682,Z*4+1:REM NO.CMDS.
290 REM****************
300 REM RUN ROUTINE/"NEW" PROGRAM
310 PRINT"JMMMSYS"C":NEWM":POKE631,13:POKE632,13:POKE198,2:END
320 REM****************
330 REM WEDGE ROUTINE
340 DATA169,7,133,127,162,5,189,15,27,149,132,202,16,248,96,76,21,27,76,28,27
350 :
360 DATA56,233,48,56,233,208,96,201,58,240,12,201,64,208,8,165,123,201,3,16,4
370 :
380 DATA169,64,56,96,162,0,32,115,0,157,161,2,201,44,240,7,232,224,8,208,241
390 :
400 DATA24,96,160,0,162,0,140,169,2,177,251,221,161,2,208,9,200,232,224,4,208
410 :
420 DATA243,56,176,14,173,169,2,24,105,4,168,204,170,2,48,223,24,96,173,169
430 :
440 DATA2,74,168,177,253,141,171,2,200,177,253,141,172,2,108,171,2,-1
1000 REM****************
1010 REM PLACE M/C ROUTINES HERE......START EACH ROUTINE WITH COMMAND NAME
1020 REM END EACH ROUTINE WITH DATA 76,121,0,-1
1030 DATAPLOT,32,253,206,32,158,215,224,22,48,5,162,14,108,0,3,138,72,32,253,206
,32
1040 DATA158,215,224,22,48,5,162,14,108,0,3,104,168,24,32,240,255,32,253,206,32,
164,202
1050 DATA76,121,0,-1
1060 :
1070 DATACOLOUR,32,253,206,32,158,215,224,8,48,3,76,72,210,138,72,32,253,206,32,
158,215
1080 DATA224,16,48,4,104,76,72,210,138,72,32,253,206,32,158,215,224,16,48,5,104
1090 DATA104,76,72,210,169,15,45,14,144,141,14,144,138,10,10,10,10,13,14,144,141
1100 DATA14,144,169,15,45,15,144,141,15,144,104,10,10,10,10,13,15,144,141,15,144
1110 DATA169,248,45,15,144,141,15,144,104,13,15,144,141,15,144,76,121,0,-1
1120 :
1130 DATADOKE,32,253,206,32,138,205,32,247,215,165,20,133,87,165,21,133,88,32,25
3,206,32
1140 DATA138,205,32,247,215,160,0,165,20,145,87,200,165,21,145,87,76,121,0,-1
1150 :
1160 DATASOUND,32,253,206,32,158,215,224,0,208,15,142,10,144,142,11,144,142,12,1
44,142,13
1170 DATA144,76,121,0,224,5,48,3,76,72,210,138,72,32,253,206,32,158,215,138,168
1180 DATA104,170,202,152,157,10,144,76,121,0,-1
1190 :
1200 DATAVOLUME,32,253,206,32,158,215,224,16,48,3,76,72,210,169,240,45,14,144,14
1,14,144
1210 DATA138,13,14,144,141,14,144,76,121,0,-1
1990 REM****************
2000 DATAEND
```

Colour mix

Jason Rider,
Butterton,
Staffordshire.

DRAGON

AS THE DRAGON can only have four colours when working in the high-resolution modes I have made this program so that the four col-

(continued on next page)

(continued from previous page)

ours of Mode 3 can be mixed to make a further 71 colours in each colour mode — green and buff.

When loaded using CLoad"colour" the computer first asks you to choose the colour resolution — green or buff.

Next you are asked how many colours you would like to mix — either two or three. After this you are asked where abouts you want to start your colouring. You enter the co-ordinates of the top left-hand corner of the area to be coloured. Now the bottom right hand set of co-ordinates are to be entered.

Lastly, you have to enter the colours which you want to mix — the same colours but in a different order will give a different shade of colour.

Now your colour is painted on the screen where you wanted it.

The following keys can now be pressed:
- B change the mode and colour to buff.
- G change the mode and colour to green.
- C will let you paint another area without clearing the other painted areas out of memory.
- A will let you have another go — all previous painted areas will be cleared out of memory.

```
10 PMODE 3:SCREEN 1,1:PCLS
20 REM COLOUR MIX BY JASON RIDER
30 Y=-1
40 CLS:PRINT:PRINT"        DRAGON COLOUR MIX"
50 PRINT:PRINT" CHOOSE COLOUR RESOLUTION......"
60 PRINT
70 PRINT"1.GREEN."
80 PRINT"2.BUFF."
90 INPUT A
100 PRINT:PRINT" HOW MANY COLOURS  (2/3)"
110 INPUT R
120 IF R<>3 AND R<>2 THEN 100
130 PRINT:PRINT" WHERE DO YOU WANT THE COLOURING TO START"
140 INPUT G:INPUT H
150 PRINT:PRINT" WHERE DO YOU WANT THE COLOURING TO FINISH"
160 INPUT N:INPUT M
170 IF A=1 THEN GOTO 200
180 IF A=2 THEN GOTO 320
190 GOTO 90
200 CLS
210 PRINT
220 PRINT" CHOOSE ";R;" COLOURS TO MIX"
230 PRINT
240 PRINT"1.GREEN"
250 PRINT"2.YELLOW"
260 PRINT"3.BLUE"
270 PRINT"4.RED"
280 INPUT B
290 INPUT C
300 IF R=3 THEN INPUT D
310 GOTO 430
320 CLS
330 PRINT
340 PRINT" CHOOSE ";R;" COLOURS TO MIX"
350 PRINT
360 PRINT"1.BUFF"
370 PRINT"2.CYAN"
380 PRINT"3.MAGENTA"
390 PRINT"4.ORANGE"
400 INPUT B
410 INPUT C
420 IF R=3 THEN INPUT D
430 IF A=1 THEN PMODE 3:SCREEN 1,0
440 IF A=2 THEN PMODE 3:SCREEN 1,1
450 FOR J=H TO M
460 Y=Y+1
470 IF Y=R THEN Y=0
480 FOR K=G+Y TO N STEP 4
490 PSET(K,J,B):PSET(K+1,J,C):IF R=3 THEN PSET(K+2,J,D)
500 NEXT K
510 NEXT J
520 A$=INKEY$:IF A$=""THEN 520
530 IF A$="B" THEN SCREEN 1,1
540 IF A$="G" THEN SCREEN 1,0
550 IF A$="A" THEN RUN
560 IF A$="C" THEN 20
570 GOTO 520
```

Windows

Richard Shergold,
Selsey,
West Sussex.

QL

THIS PROGRAM for the QL starts at line 32500 so that it can be put at the end of a program and called when needed. It allows QL owners to design their own windows using cursor control and text input. This puts an end to any trial and error methods of window design that many QL users are used to. To operate the program type Windows.

After entering the window number you require you may move the window around by using the cursor keys — Ctrl + cursor key gives extra zip.

You can also adjust the size of your window by using the Alt key with the cursor keys. To see exactly how big the window is with regards to character size you may enter text by pressing F1.

F2 will allow you to change window numbers and Esc will allow you to return to your original program and use your designed window.

```
32500 DEFine PROCedure windows
32501 PAPER 1:INK 7:PAPER£0,0:INK£0,7
32502 CLS:CLS£0
32503 INPUT£0,"WIDTH? :",wid:INPUT£0,"HEIGHT? :",height
32504 a=100:b=100
32505 INPUT£0,"Window no :",win
32506 IF win<3 THEN GO TO 32505
32507 CLS£0
32508 OPEN£win,scr
32509 IF wid+a>480 THEN LET a=480-wid
32510 IF a<0 THEN LET a=0
32511 IF b<16 THEN LET b=16
32512 IF b+height>216 THEN b=216-height
32513 WINDOW£win, wid,height,a,b
32514 AT£0,0,0:PRINT£0;"        ";:INK£0,7:PRINT£0;"Window£";win;" ";wid;" ";heigh
t;" ";a;" ";b;"  ":INK£0,4:PRINT£0:PRINT£0\"CURSORS=MOVE      F2=CHANGE      ALT=SIZ
E"\"CTRL=ZIP          F1=TEXT          ESC=QUIT"
32515 BORDER£win,1,7
32516 z=CODE(INKEY$(-1))
32517 SELect ON z
32518 =200 : a=a+1
32519 =232:text
32520 =192 : a=a-1
32521 =208:b=b-1
32522 =216:b=b+1
32523 =201:wid=wid+1
32524 =193:wid=wid-1
32525 =209:height=height+1
32526 =217:height=height-1
32527 =236 :windows
32528 =202:a=a+10
32529 =194:a=a-10
32530 =210:b=b-10
32531 =218:b=b+10
32532 =27:END DEFine windows
32533 END SELect
32534 CLS£2
```

(continued on page 201)

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The Word Processor

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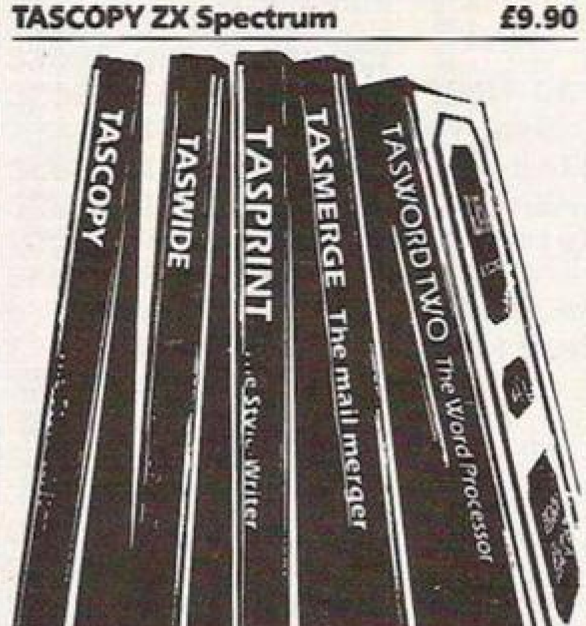

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(continued from page 198)

```
32535 GO TO 32509
32536 DEFine PROCedure text
32537 CURSOR£win,0,0
32538 CLS£0:INPUT£0,"ENTER TEXT ";u$:PRINT £win,u$
32539 PAUSE 200:CLS£0
32540 END DEFine
```

Find

Alan Wagstaff,
Skeeby, Richmond,
North Yorkshire.

LINEFIND locates any specified string in a Basic program and prints the numbers of all lines containing the string. It will not locate Basic keywoards. It responds to the command

*LINE str

The listed program points the vector UseRV at &C00 and assembles the machine code there. To place it at a different address, change lines 150 and 1020.

If your micro is equipped with Basic 1 — most are — then you can save yourself a lot of typing. Change line 510 to read simply

510JSR&98F9

then omit lines 1040 to 1440 inclusive. If you aren't sure which Basic you have then enter

PRINT?&8015

If the answer is 49 then you have Basic 1.

Having entered the listing, Save it then Run it. The code can now be tested by entering

*LINE LDA

The numbers of all lines containing LDA should appear on the screen. If not, check your listing. Pressing Break at any time will disconnect the code. Reconnect it by entering the contents of line 1020 as a direct command. It can be useful to put this command on to a user defined key.

As long as the machine code is undisturbed, and the vector is pointing at it, the

*LINE str

command can be used with any Basic program you load into the micro.

```
LIST
   10GOTO80
   20      *** LINEFIND ***
   30
   40      A WAGSTAFF  1984
   50
   60  use the command   *LINE str
   70
   80P=&70
   90S=&72
  100PR=&74
  110ST=&75
  120T=&76
  130F=&77
  140FORPASS%=0TO2 STEP2
  150P%=&C00
  160[OPT PASS%
  170STX S        store string
  180STY S+1      address in S/S+1
  190LDA#3
  200TAX          prog pointer=3
  210LSR A
  220STA P
  230LSR A
  240STA PR
  250STA F        pull flag down
  260LDA&18       page+1 into P/P+1
  270STA P+1
  280.a
  290LDY#0
  300LDA(P),Y     get prog byte
  310CMP#255      end of program ?
  320BNE b        if not, goto b
  330JSR&FFE7     else newline
  340RTS          and finish
  350.b
  360INY
  370INY
  380LDA(P),Y     get line length
  390PHA          and store it
  400.c
  410LDY PR       string pointer
  420LDA(S),Y     get string char
  430CMP#13       end of string ?
  440BNE d        if not, goto d
  450LDY#0
  460LDA(P),Y     get line no. msb
  470STA&2B
  480INY
  490LDA(P),Y     get line no. lsb
  500STA&2A
  510OPT FNCODE   print line no.
  520JMP g        goto g
  530.d
  540STA ST       store str char
  550TXA
  560TAY          prog pointer
  570.e
  580LDA(P),Y     get prog byte
  590CMP#13       end of prog line ?
  600BEQ g        if so, goto g
  610INY          step pointer on
  620CMP ST       prog char=str char ?
  630BEQ f        if so, goto f
  640LDA F        get flag
  650BEQ m        if down, goto m
  660DEY          step pointer back
  670LDA#0
  680STA F        pull flag down
  690.m
  700TYA
  710PHA          store prog pointer
  720LDY#0
  730STY PR       reset str pointer
  740LDA(S),Y     get 1st str char
  750STA ST       and store it
  760PLA
  770TAY          retrieve prog pointer
  780BNE e        goto e
  790.f
  800STA F        put flag up
  810TYA
  820TAX          store prog pointer
  830INC PR       step str pointer on
  840JMP c        goto c
  850.g
  860LDX#3        reset prog pointer
  870LDA#0
  880STA PR       reset str pointer
  890PLA          get line length
  900CLC
  910ADC P
  920STA P
  930LDA#0
  940ADC P+1      add to prog address
  950STA P+1      for next line
  960JMP a        goto a
  970.M
  980]
  990NEXT
 1000FORF%=M TO M+9:READ ?F%:NEXT
 1010DATA1,10,100,232,16,0,0,0,3,39
 1020?&200=0:?&201=&C
 1030END
 1040DEF FNCODE
 1050[OPT PASS%
 1060LDY#4
 1070.h
 1080LDA#0
 1090STA&3F,Y
 1100SEC
 1110.i
 1120LDA&2A      get line no. lsb
 1130SBC M,Y
 1140STA T
 1150LDA&2B      get line no. msb
 1160SBC M+5,Y
 1170BCC j
 1180STA&2B
 1190LDA T
 1200STA&2A      convert
 1210LDA#0       line
 1220ADC&3F,Y    number
 1230STA&3F,Y    into
 1240SEC         decimal
 1250BNE i
 1260.j
 1270DEY
 1280BPL h
 1290LDY#5
 1300.k
 1310DEY
 1320BEQ l
 1330LDA&3F,Y
 1340BEQ k
 1350.l
 1360LDA&3F,Y
 1370ORA#&30
 1380JSR&FFEE    and print it
 1390DEY
 1400BPL l
 1410LDA#32      followed by
 1420JSR&FFEE    a space
 1430]
 1440=PASS%
```

Sprite control

Martin Wicks,
Southampton.

CBM-64

THIS SIMPLE BASIC program solves the problem of linking together a simple sprite program and a read-joystick routine.

The program also incorporates several user functions which allows the user to alter the screen image. Here are the keys and their functions:

Key	Function
I	Puts sprite in front of data
B	Puts sprite behind data
H	Puts sprite into hi-res mode
M	Puts sprite into multi-colour mode
X	Expands sprite in X Direction
Y	Expands sprite in Y Direction
U	Unexpands sprite in Y direction
V	Unexpands sprite in X direction
O	Turns sprite off
S	Turns sprite on

(continued on page 204)

```
0 CLR
1 A=5:B=5:C=1
2 X=100:Y=100
5 POKE650,PEEK(650)OR128
10 V=53248
11 POKEV+39,7
20 POKEV+21,1
30 POKEV+32,B
40 POKEV+33,C
```

(listing continued on page 204)

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(continued from page 201)

- P Changes screen background colour
- Q Changes screen border colour
- C Changes sprite colour
- R Jumps to system cold start
- W Clears the screen
- E Ends Program
- A Changes sprite multi-colour 0
- D Changes sprite multi-colour 1

To get the full effect of the sprite priority, List the program before running.

I have also included four different sets of sprite data which have been saved after the initial program. These are to show the full effect of the sprite multi-colour because you cannot see the multi colour on a simple square sprite. The sprite data should be inserted at about line 5000, at the end of the initial program, and the following alteration should be made:

70 FOR N = 0 to 62; Read Q; POKE 12288 + N,Q:NEXT

When you use the multi-colour change function, the border and background colours must be altered when the multi-colour change is made.

The actual program uses the joystick in port 1 to move the sprite, and the user functions may only be used when the sprite is in a stationary position.

Finally, here is a program listing description:

- 0 clears variables.
- 1-2 sets up variables.
- 5 puts a repeat on all keys.
- 10 sets up Vic chip.
- 11 sets up sprite 0 colour.
- 20 turns on sprite 0.
- 30-50 sets up character border and background colours.
- 60 Pokes sprite 0 pixel data.
- 70 positions sprite 0 pixel data.
- 95 positions sprite 0 on screen.
- 96-99 sets up screen limit for sprite.
- 130-200 sets up read joystick routine.
- 300-390 user functions.
- 1000 returns to 95.
- 5000 sprite data should be inserted here and the given changes made.

(listing continued from page 201)

```
50 POKE646,5
60 POKE2040,192
70 FORN=0TO62:POKE12288+N,255:NEXT
95 POKEV,X:POKEV+1,Y
96 IFY<50THENY=Y+5
97 IFY>230THENY=Y-5
98 IFX<25THENX=X+5
99 IFX>250THENX=X-5
130 Q=PEEK(56321)
140 IFQ=254THENY=Y-5
150 IFQ=246THENY=Y-5:X=X+5
160 IFQ=247THENX=X+5
170 IFQ=245THENX=X+5:Y=Y+5
180 IFQ=253THENY=Y+5
190 IFQ=249THENX=X-5:Y=Y+5
195 IFQ=251THENX=X-5
200 IFQ=250THENX=X-5:Y=Y-5
300 REM**USER FUMCTIONS**
310 GETA$
320 IFA$="I"THENPOKEV+27,0
325 IFA$="B"THENPOKEV+27,1
330 IFA$="M"THENPOKEV+28,1
331 IFA$="A"THENPOKEV+28,1:POKEV+37,C+1
332 IFA$="D"THENPOKEV+28,1:POKEV+38,C+1
333 IFA$="H"THENPOKEV+28,0
335 IFA$="E"THENEND
340 IFA$="X"THENPOKE53277,PEEK(53277)OR(2↑0)
345 IFA$="Y"THENPOKE53271,PEEK(53271)OR(2↑0)
350 IFA$="U"THENPOKE53271,PEEK(53271)AND(255-2↑0)
352 IFA$="V"THENPOKE53277,PEEK(53277)AND(255-2↑0)
355 IFA$="O"THENPOKE53269,PEEK(53269)AND(255-2↑0)
360 IFA$="S"THENPOKE53269,PEEK(53269)OR(2↑0)
365 IFA$="P"THENC=C+1:POKE53281,C+1
370 IFA$="Q"THENB=B+1:POKE53280,B+1
375 IFA$="C"THENA=A+1:POKEV+39,A
385 IFA$="W"THENPRINT"♥"
390 IFA$="R"THENSYS64738
1000 GOTO95
```

Proton pursuit

Steve Fletcher,
Hallowers,
Dronfield.

SPECTRUM

THIS PROGRAM is a very fast pursuit game for any Spectrum. The idea behind the game is original and in it you take on the roll of the nucleus of an atom who is free to move within the atom but must avoid the stationary electrons which are randomly scattered about.

The protons of the atom are attracted to the nucleus and therefore pursue you whereever you move. If a proton catches the nucleus the game ends, but to avoid being caught you must lure the protons into the stationary electrons. When all the protons have been eliminated you start a new atom with different protons. The game allows you to have 3 to 9 protons chasing you at a speed of 1-5 giving a possible of 30 different atoms!

A high score is kept which is initially 500. Control is up, down, left and right by the keys Q,A,O,P respectively. To set up the game type in listing 1 and save it on to tape using

SAVE "PROTON" LINE 220

Now type in listing 2 and run it. If any error is found in the data the program will tell you which line needs changing. When the data is all poked in correctly, save it with:

SAVE "PROTONCODE" CODE 27000,958

The game is now ready to play. To play it rewind the cassette and type Load" ".

Listing 1.

```
   5 REM ************************
  10 REM Proton Pursuit SEF© '84
  20 REM ************************
  25 LET sc=0: LET hi=500: LET a
$="Steve"
  30 RANDOMIZE : PAPER 6: BORDER
 6: INK 0: CLS
  40 PRINT AT 10,2;"Enter number
 of Protons(3-9)"
  50 LET d$=INKEY$: IF CODE d$>5
0 AND CODE d$<58 THEN GO TO 70
  60 GO TO 50
  70 LET a=CODE d$-48: FOR f=1 T
O (a*2) STEP 2: POKE f+28999,INT
 (RND*19)+1: POKE f+29000,INT (R
ND*29)+1: NEXT f
  80 CLS : PRINT AT 10,8;"Enter
speed (1-5)"
  90 LET d$=INKEY$: IF CODE d$>4
8 AND CODE d$<54 THEN LET b=CODE
 d$-48: GO TO 110
 100 GO TO 90
 110 FOR f=1 TO (a*2)+b STEP 2:
POKE f+29019,INT (RND*19)+1: POK
E f+29020,INT (RND*29)+1: NEXT f
 120 PAPER 0: INK 7: BORDER 2: C
LS
 130 POKE 27221,b
 135 POKE 23659,0: PRINT AT 22,3
1; INK 7; BRIGHT 1; PAPER 2;" St
eve Fletcher © 26/5/84  PROTON"
 140 RANDOMIZE USR 27741
 150 POKE 23659,2
 160 IF PEEK 28500<>255 THEN LET
 sc=sc+(30*a)+10-(20*b): GO TO 3
0
 165 PRINT AT 10,11; FLASH 1;" S
CORE ";sc;" "
 166 FOR f=0 TO 400: NEXT f
 170 IF sc<=hi THEN GO TO 190
 180 LET hi=sc: PAPER 5: BORDER
4: INK 7: CLS : PRINT AT 8,6; FL
ASH 1; PAPER 2;"* A NEW HIGH SCO
RE *": PRINT AT 12,5; PAPER 3;"E
nter your name please": INPUT a$
 190 PAPER 3: BORDER 2: INK 7: C
LS : RANDOMIZE USR 27150: PRINT
AT 8,8;"Today's highest ";AT 11,
8;a$;" ";hi
 200 FOR f=0 TO 300: LET sc=0: N
EXT f
 210 PAUSE 0: GO TO 30
 220 LOAD ""CODE : RUN
```

Listing 2.

```
   1 REM ** PROTON LISTING 2 **

   2 DEF FN x(a$)=16*(CODE a$-48
-(39 AND a$(1)>"9"))+CODE a$(2)-
48-(39 AND a$(2)>"9")
   3 LET a=27000
   4 FOR f=10 TO 150 STEP 10: RE
AD a$: LET t=VAL a$( TO 4): LET
a$=a$(5 TO )
   5 FOR b=0 TO 63
   6 LET z=FN x(a$(b*2+1 TO b*2+
2)): POKE a,z: LET a=a+1: LET t=
t-z: NEXT b: IF NOT t THEN NEXT
f: PRINT "Finished": STOP
   7 PRINT "Error in line ";f: S
TOP
  10 DATA "5511210040060 3c5C5CC:
57efe10200511f5691815fe81200511f
```

(continued on page 207)

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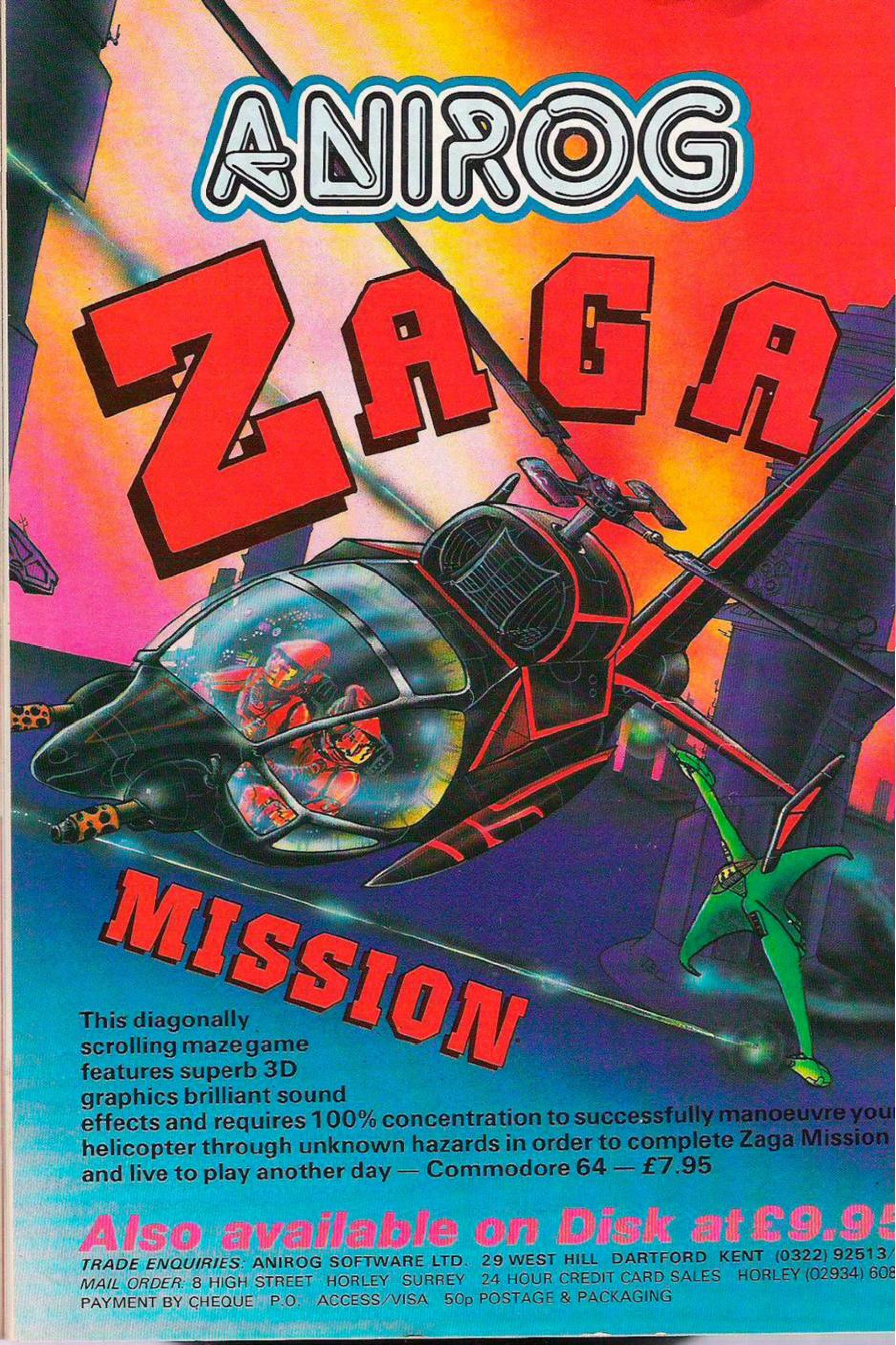
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(continued from page 204)

```
e69180cc12310e811000719c110dec9e
526081a77132410fae118e8003e30110
56a328369ed5387"
  20 DATA "7186693e0c11e669328c6
9ed539069cd78693e1011f669328369e
d5387693e8111fe69328c69ed539069c
e7869c900003078fcfc783000003c66c
38181c3663c8142"
  30 DATA "50213c3c3c3c428110101
038ff3810100c1e3f3f1e0c0000114d6
aed53536a11a0022100580620cd356ae
51977e12310f60614111f00cd356a197
72310f8c9d5ed5b"
  40 DATA "6034536a1a7713f57bfe5
32003114d6aed53536af1d1c9b9b2aba
49d96516a02606d2e6ded5b566a1afe1
03009fe06300c2100401800c210050d61
0180521000048d608"
  50 DATA "5315d5fe0028071120004
71910fdd1131a472310fded5b586a060
81a77241310fa2a566a5e23563a8f5c2
1005843d51120001910fdd15a1600197
7c921566a1afe63"
  60 DATA "6695280dfe00c8732372e
5d5cd5a6ad1e1131318e7cd0e6a21e66
922586a1148713e03328f5ccdb26a21f
6692258 6a115c713e05328f5ccdb26a2
1ee6922586a1160"
  70 DATA "73716ded53566a3e07328
f5ccd5a6ac90000dd21606ddd7e00dd7
702dd7e01dd77033edfdbfee602200cd
d7e01fe01c83ddd770118393edfdbfee
601200cdd7e01fe"
  80 DATA "72151ec83cdd770118253
efbdbfee601200cdd7e00fe01c83ddd7
70018113efddbfee601c0dd7e00fe14c
83cdd770011307 5ed53586a11626ded5
3566a3e07328f5c"
  90 DATA "7144cd5a6acd906b11ee6
9ed53586a11606ded53566acd5a6ac92
10058ed5b606d43d51120001910fdd15
a1600197efe07c83eff32546fc921487
17efe632871fe00"
  100 DATA "5395c822566a113075ed5
3586a3e07328f5ce5cd5a6ae17e573a6
06dba2806300335180134237e573a616
dba2806300335180134 2b22566a11e66
9ed53586a3e0332"
  110 DATA "69978f5ccd2b6ce5cd5a6
ae1d5e5cd4a6ce1d13a556ffe6320171
13075ed53586a3e07328f5ce5cd5a6ae
13663af32556f23231886e55e2356210
05843d511200019"
  120 DATA "739310fdd15a1600197ee
1fe05c03e63325556fc9563a606dbac02
3563a616dbac03eff32546fc9af32546
f110a0fed53606dcdcb6a0664c5cd086
bcda56cc110f63a"
  130 DATA "7177556a3c47c5cd086bc
da56cc13a546ffeff2836214871 7efe0
02857fe632004232318f310dfcdad69c
dae6b18d20602c50614c5060010fe:11
0f6c110f2c92148"
  140 DATA "705571af066477 2310fcc
921606d22566a212e6d22586acd5a6a0
603c50600c506003e3ad3fe3edfd3fe1
0f6c110f0c110ea18cc21b86f22566a1
1e669ed53586acd"
  150 DATA "7229fc6c181d110101ed5
3b66fd5cd5a6ad1147afe1f280218ef1
6011c7bfe15c618e60614c5cdad69c11
0f9212e6d22586acdfc6c18a3003c7ef
ffffff7e3c0000"
```

Paint routine

S Linnik,
Nuneaton,
Warwickshire.

THIS MACHINE-CODE paint routine is for the Oric 1 or Atmos 16 or 48K. It will fill any outline given a point inside it, in Ink or Paper.

The initial point is set from Basic using the Curset, Curmov, or Draw instructions. This is followed by a Call to the routine.

Whether the outline is "painted" in Ink or Paper depends on the value of a memory location whose address is printed in line 70 of the machine-code loader. If this location contains a 0 then an Ink paint will result, if 255 then Paper.

The FB value of the above graphic instructions can be used to set this location. A 0 will set it to 0, and a 1 to 255. This means that the type of paint used will be opposite to that of the point plotted. The address can also be Poked with the desired value in which case the FB value must be 2 or 3. These values leave the location unaffected.

Screen attributes are not altered by painting and are treated as a row of six set points.

The routine can be relocated in memory by altering the value of the variable HI in line 20. This is the highest address used by the machine-code routine. The value given will place the program at the top of user memory in Hires mode on the 48K machine. For 16K machines the values in lines 10 and 20 should be altered as shown in the listing.

The program uses a stack whose size is set by variable ST in line 30. With the value given, the program uses 1,328 bytes of memory. 16K machine owners might like to save memory by reducing this value — using a value of 85 will save 0.5K bytes.

```
10 SI=0        'for 16K machines use SI=32768
20 HI=38900    'for 16K machines use HI=6132
30 ST=255      'stack size (255 is maximum)
35 :
40 CA=HI-510:PRINT "call program with CALL ";CA:PRINT
50 PRINT "to CSAVE program as data block use    addre
sses A";
60 PRINT HEX$(CA-23);",E";HEX$(HI)
70 PRINT:PRINT "POKE address for INK/PAPER paint=";CA
-23
75 :
80 PRINT:PRINT "checking data..."
90 FOR LI=0 TO 37:CS=0:FOR BY=0 TO 13
100 READ V:CS=CS+V:NEXT BY
110 READ CV:IF CV<256 THEN GOTO 130
120 IF CS=CV THEN NEXT LI:GOTO 140
130 PRINT "checksum error in line ";1010+10*LI:END
140 PRINT "checksum ok... type L to load program"
150 GET A$:IF A$<>"L" THEN END
155 :
160 RESTORE:PRINT:PRINT "loading..."
170 FOR LI=CA-7 TO CA+497 STEP 14:FOR BY=0 TO 13
180 READ V:POKE LI+BY,V
190 NEXT BY:READ V:NEXT LI
200 FOR BY=1 TO 12:READ V:A=CA+V
210 DOKE A,DEEK (A)+HI-38900:NEXT BY
220 DOKE CA-8,CA-42-ST:DOKE CA-10,CA-42-2*ST:DOKE CA-
12,CA-42-3*ST
230 DOKE CA-14,48920-SI:DOKE CA-16,41176-SI:DOKE CA-1
8,40920-SI
240 DOKE CA-23,256*ST
250 PRINT "HIMEM set to ";HI-560-3*ST:HIMEM (HI-560-3
*ST):END
255 :
1010 DATA 1,32,16,8,4,2,1,120,32,229,151,32,2,150,780
1020 DATA 32,229,151,88,96,173,229,2,201,2,176,6,73,2
55,1713
1030 DATA 170,232,134,20,173,25,2,162,255,56,233,6,23
2,176,1876
1040 DATA 251,105,6,168,185,240,149,133,1,138,24,101,
25,133,1659
1050 DATA 2,169,0,101,26,168,174,26,2,240,13,169,40,2
4,1154
1060 DATA 101,2,133,2,144,1,200,202,208,243,162,0,134
,12,1544
1070 DATA 134,13,134,19,166,2,165,1,32,184,150,164,13
,196,1373
1080 DATA 12,208,1,96,177,33,133,10,177,35,133,11,177
,31,1234
1090 DATA 133,9,41,128,133,15,16,26,165,10,56,233,40,
133,1138
1100 DATA 10,176,2,198,11,200,196,21,208,2,160,0,132,
13,1329
1110 DATA 6,9,70,9,16,6,177,31,9,128,145,31,162,0,799
1120 DATA 134,6,134,14,232,32,213,150,162,255,32,213,
150,165,1892
1130 DATA 14,208,16,165,6,240,23,133,11,165,5,133,10,
165,1294
1140 DATA 4,133,9,16,221,164,6,240,7,165,4,166,5,32,1
172
1150 DATA 184,150,184,80,150,132,16,164,12,145,31,138
,145,33,1564
1160 DATA 165,16,145,35,200,196,21,208,2,160,0,132,12
,196,1488
1170 DATA 13,208,2,104,104,96,134,17,162,0,134,18,134
,7,1133
1180 DATA 134,8,165,15,240,4,230,7,208,2,230,8,165,11
,1427
1190 DATA 133,3,165,10,133,2,165,9,133,1,165,3,197,28
,1147
1200 DATA 176,7,166,2,228,27,176,1,96,197,30,144,7,16
6,1423
1210 DATA 2,228,29,144,1,96,160,40,177,2,168,69,20,37
,1173
1220 DATA 1,240,7,165,19,208,2,104,104,96,152,41,96,2
40,1475
1230 DATA 250,162,0,160,0,177,2,168,41,96,208,4,169,1
,1438
1240 DATA 208,12,152,69,20,37,1,208,5,164,7,240,1,232
,1356
1250 DATA 133,7,160,80,177,2,168,41,96,208,4,169,1,20
8,1454
1260 DATA 13,152,69,20,37,1,208,6,164,8,240,2,232,232
,1384
1270 DATA 133,8,138,240,74,224,3,240,51,165,2,164,15,
240,1697
1280 DATA 14,224,2,240,41,56,233,40,170,165,3,233,0,2
08,1629
1290 DATA 12,224,1,240,27,24,105,40,170,165,3,105,0,1
68,1284
1300 DATA 165,6,240,25,165,4,197,1,208,8,228,5,208,4,
1464
1310 DATA 196,6,240,19,165,1,166,2,164,3,230,14,76,18
4,1466
1320 DATA 150,165,1,133,4,134,5,132,6,165,18,208,8,23
0,1359
1330 DATA 18,165,17,133,19,16,8,160,40,165,1,81,2,145
,970
1340 DATA 2,165,1,166,17,48,13,74,144,25,169,32,230,2
,1088
1350 DATA 208,19,230,3,208,15,10,201,33,144,10,169,1,
166,1417
1360 DATA 2,208,2,198,3,198,2,133,1,76,245,150,162,36
,1416
1370 DATA 181,0,188,203,149,157,203,149,148,0,202,208
,243,96,2127
1380 DATA 2,5,8,40,86,153,158,189,426,493,500,503,1,1
,2565
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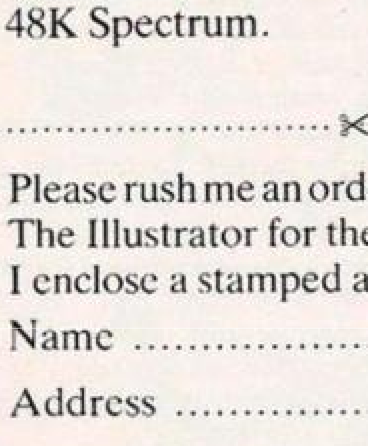

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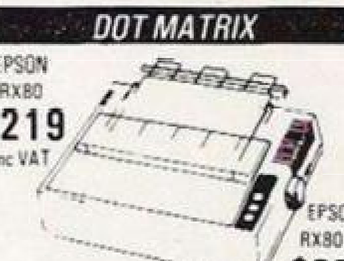

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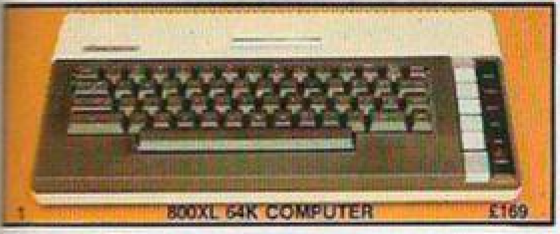
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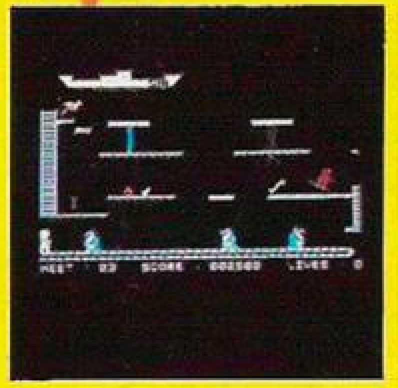

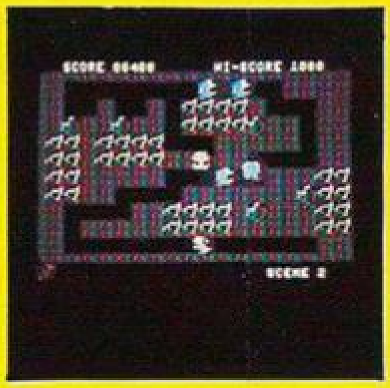

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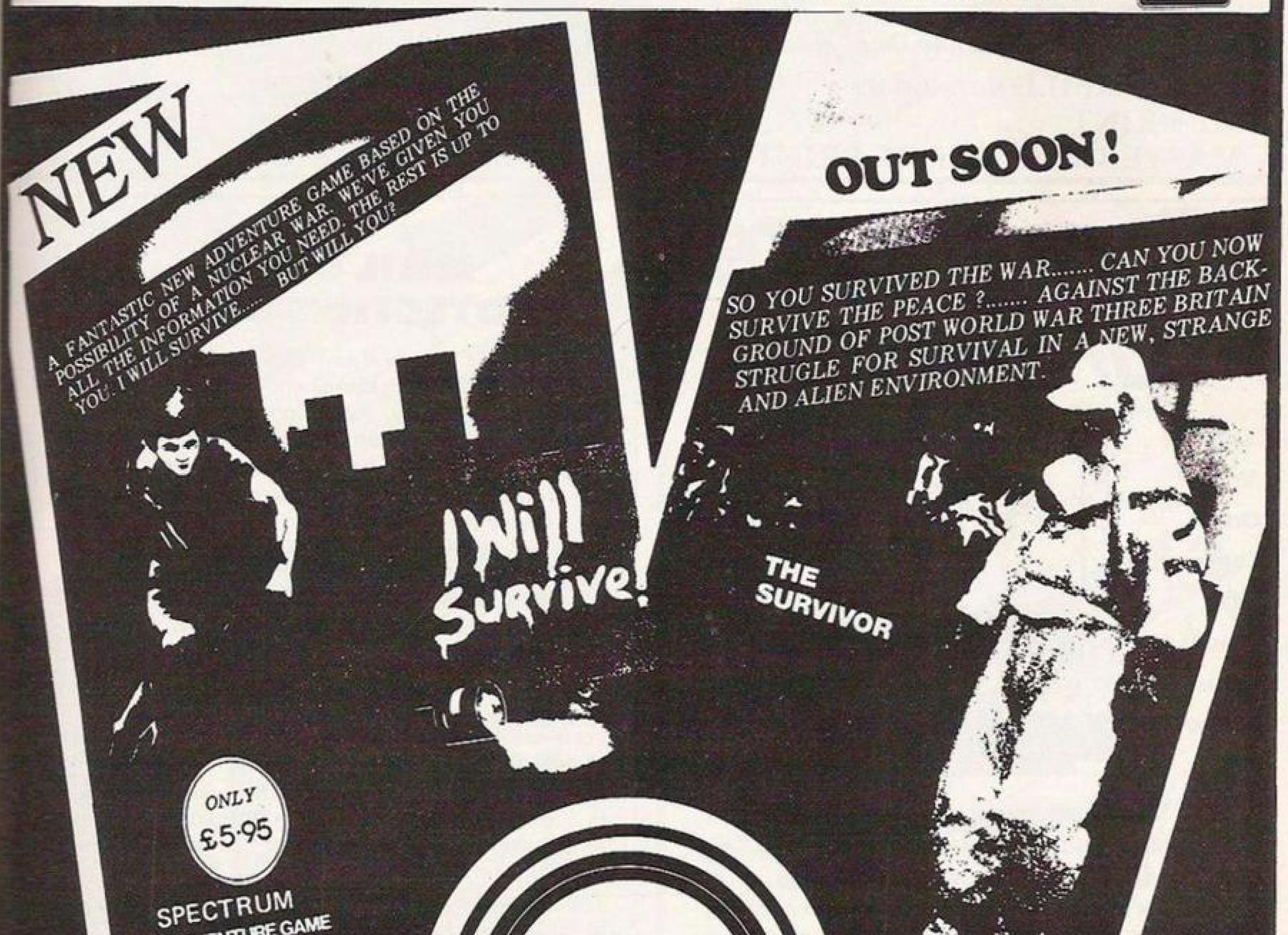

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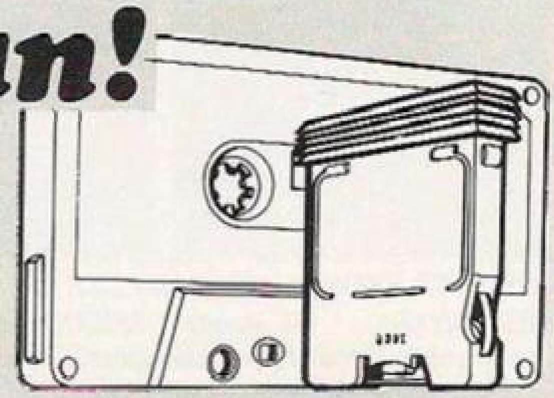

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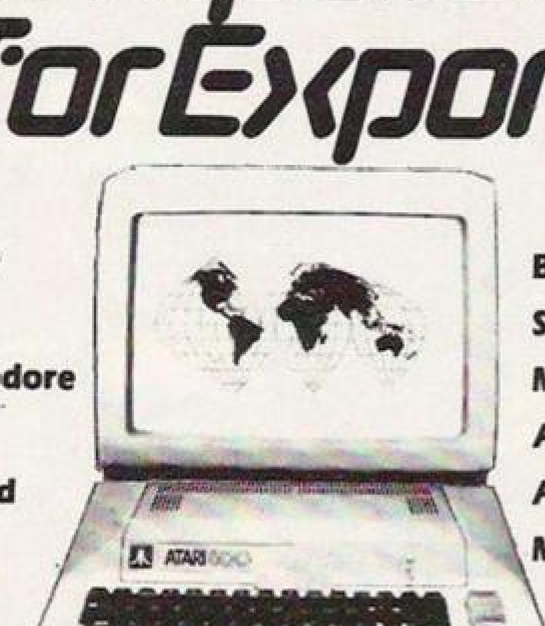

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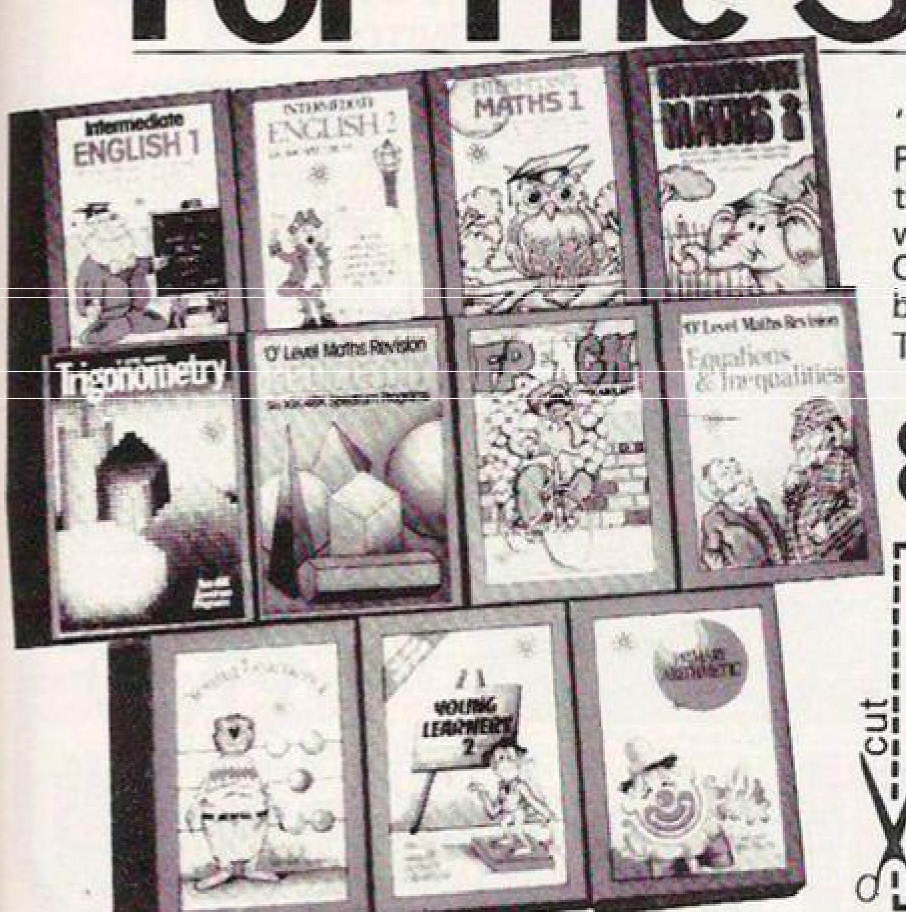

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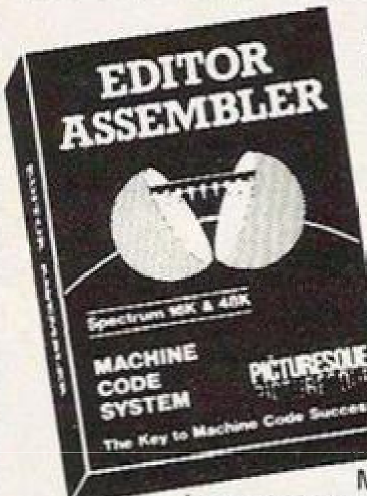

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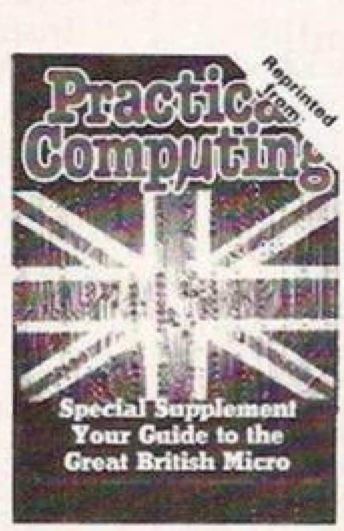

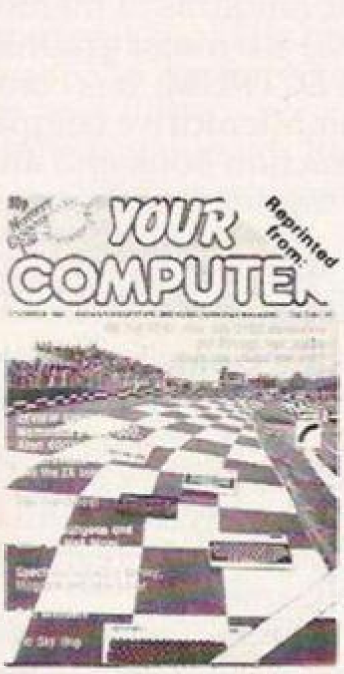

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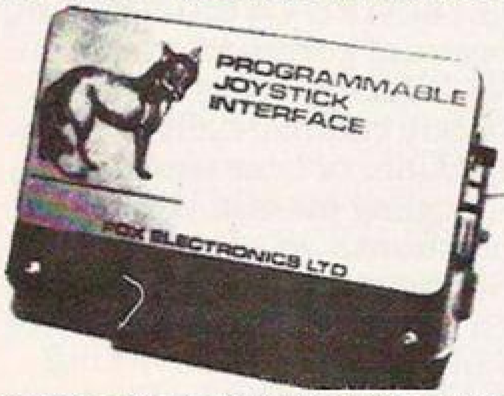

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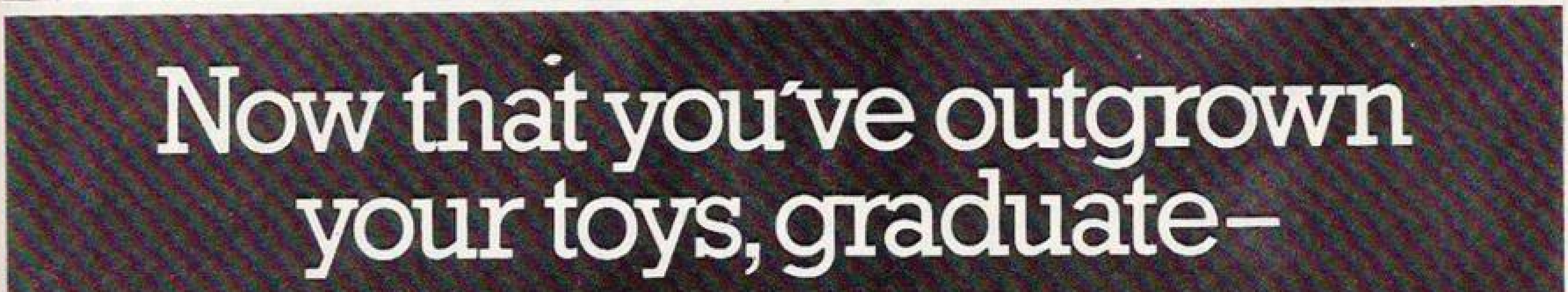
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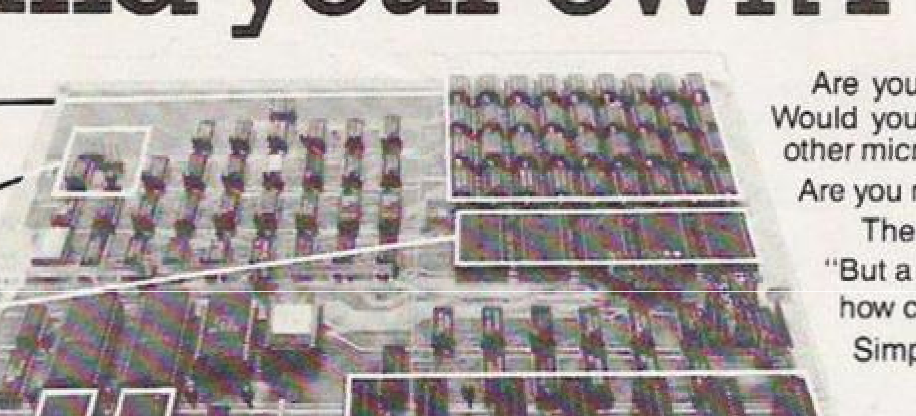

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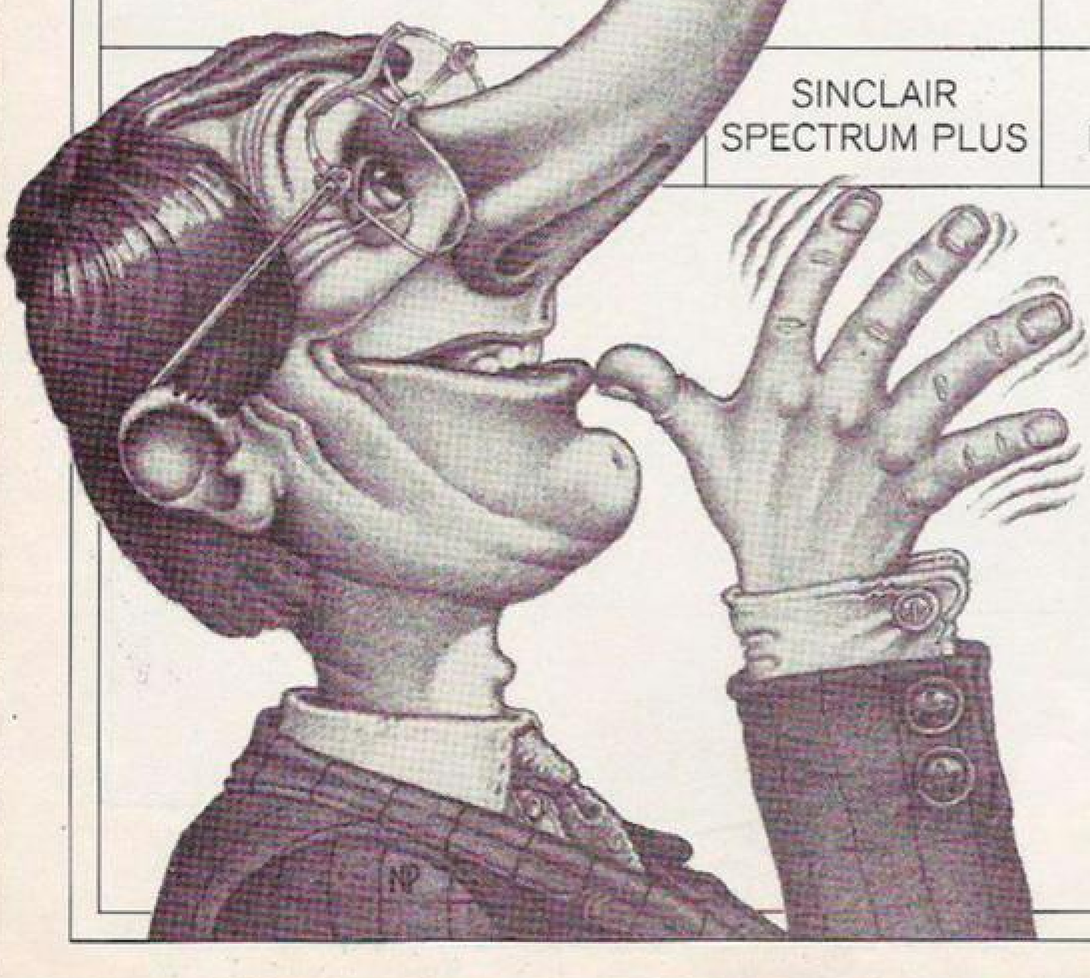

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The Advance 86 runs IBM PC software.

Specification

CPU Type	True 16-bit 8086 running at 4.77 MHz.
RAM	128K or 256K with parity plus 16K video
Languages Included	Basic
Type of Keyboard	Full 84 keys tactile
Keyboard Facilities	10 programmable keys
Character Set	256 in ROM
Method of Display	TV, RGB, Comp/Sync colour or monochrome monitor
Display Facilities	Full screen handling, 4 screen paged
Text	80 x 25 or 40 x 25
Graphics Resolution	320 x 200 or 640 x 200
Colours Available	16
Graphics Facilities	Scroll, reverse image
Cassette Recorder	Audio
Interfaces Included	Cassette port, light pen, joystick, Centronics
Sound	Built-in speaker
Operating System	Built-in ROM
Printers	Any using Centronics parallel interface
Comments	Hardware and software compatible with IBM PC Upgradeable to Model B Provision for 8087 Arithmetic Processor
Warranty	12 months

The business user can upgrade to Model B by adding the Advance Expansion box containing 2 × 5.25″ disc drives providing 720K storage at £740 + VAT.
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Advance 86 Models A & B are designed and marketed by Advanced Technology UK Ltd. Made by Ferranti in Oldham. Delivery within 30 days from receipt of payment. 128K memory expansion £108.70 + VAT.

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Benchmarks

The standard Benchmarks were run using Advance Basic, which is the equivalent of Microsoft GWBasic and Basica on the IBM PC.

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ACT Apricot — 8086	1.6	5.2	10.6	11.0	12.4	22.9	35.4	34.4	16.7
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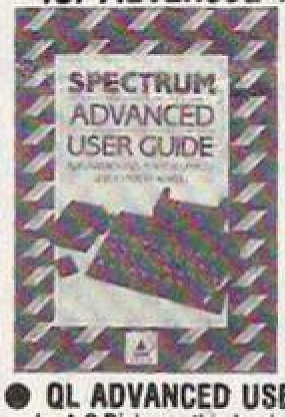

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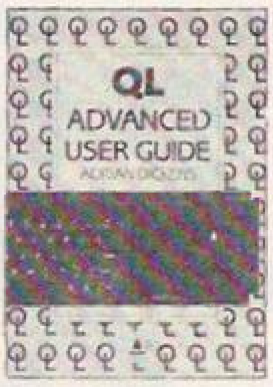

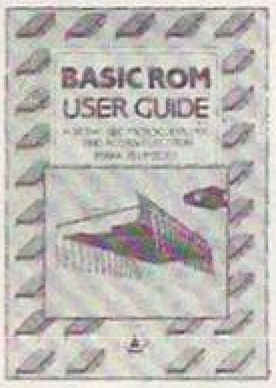

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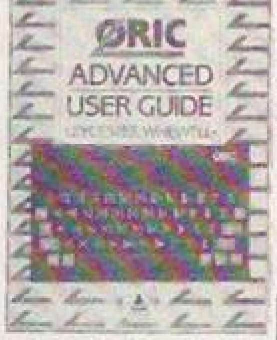

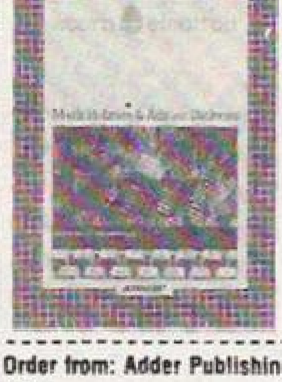

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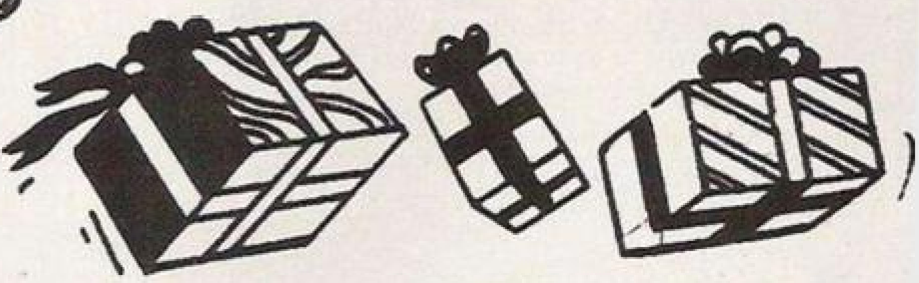

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And if you ask their advice on choosing a home computer for around £200, they're likely to tell you that there's really only one sensible choice.

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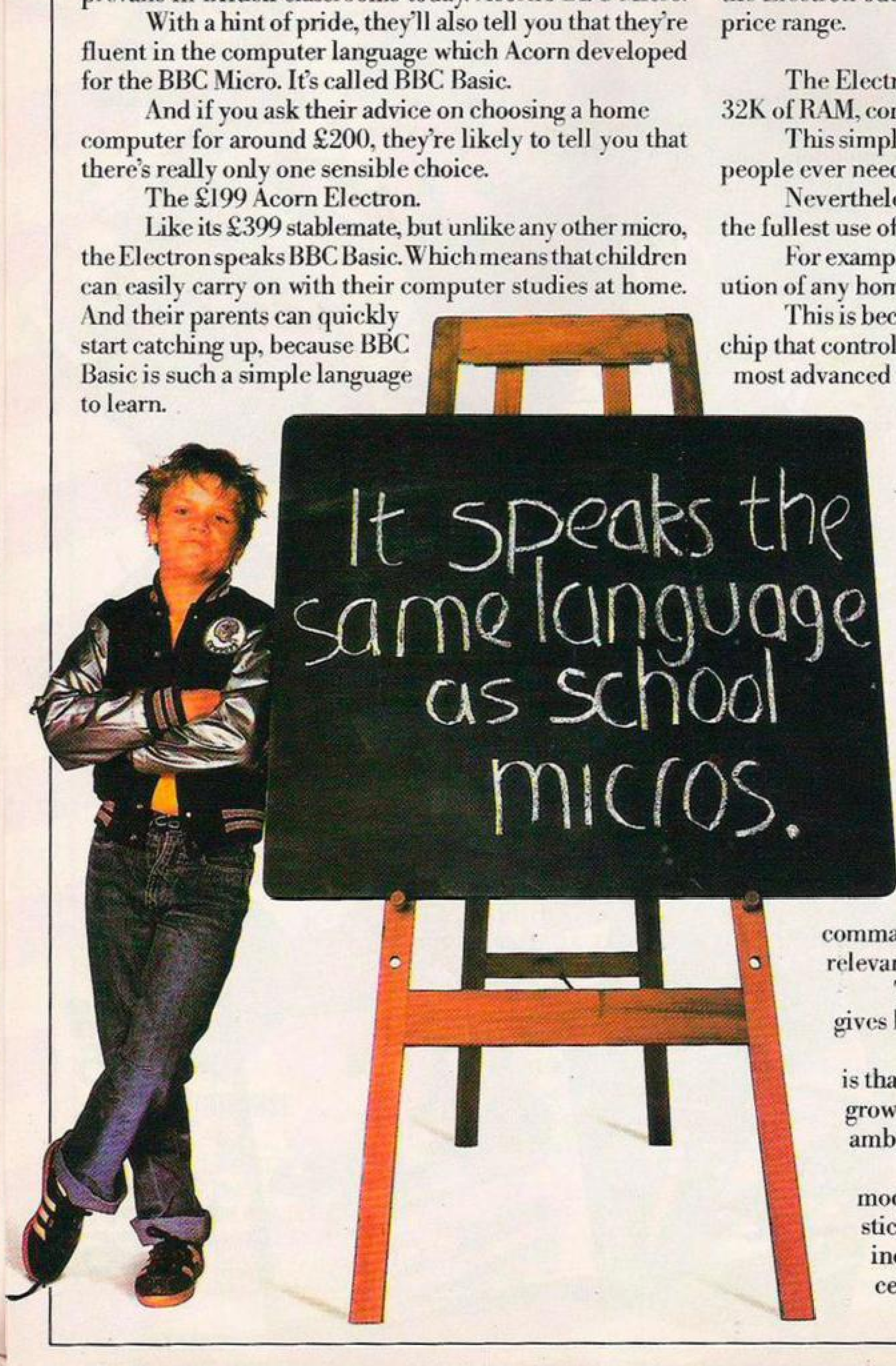
Like its £399 stablemate, but unlike any other micro, the Electron speaks BBC Basic. Which means that children can easily carry on with their computer studies at home. And their parents can quickly start catching up, because BBC Basic is such a simple language to learn.



However, language isn't the only thing whic the Electron outstanding among every other mi price range.

A powerful choice.

The Electron is a 64K microcomputer whi 32K of RAM, combined with another 32K ROM.

This simply means that it has more power t people ever need from a home computer.

Nevertheless, it has been designed to help y the fullest use of its power.

For example, its graphics have the highest r ution of any home computer bar none.

This is because Acorn specially designed t chip that controls the graphics. And it's among t most advanced chips of its kind.

Indeed, it delivers twic as many characters across th screen as the Electron's neare rival.

It expands into a syste

With the Electron, ev newcomers have been surp how quickly they can find into the complex world of c

Where many compu keyboards which are conf clumsy to operate, it has a just like an ordinary elect typewriter's.

And for issuing ma mands, there are single e Instead of literally spelli command, letter by letter, you just pu relevant key and it's issued.

There's also a built-in loudspea gives high quality sound.

And what is perhaps most excit is that the Electron has the capacity grow with your knowledge and ambition.

With Acorn's Plus 1 expansi module, it can link up with a prin sticks and fast-load cartridge soft including View and Viewsheet cessing and spread sheet progra

With the Plus 3 module, which will soon be available, you'll have a disc drive system and will be able to enjoy all the speed and convenience of 3.5 inch discs.

But let's not get carried away too quickly. You can start using and enjoying your Electron as soon as you get it home.

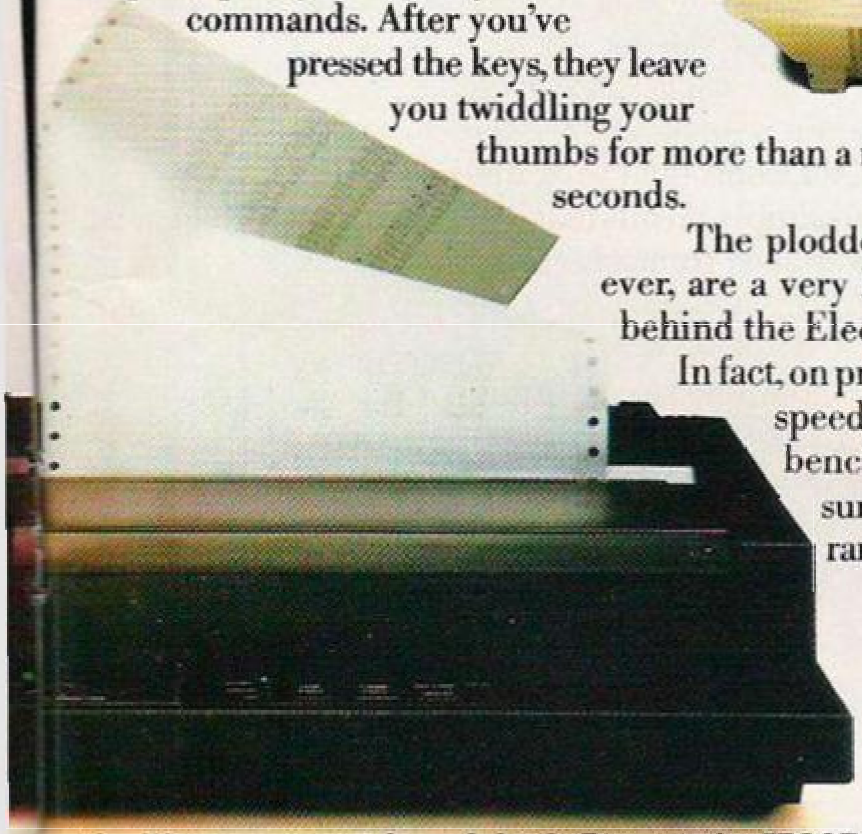
All you need is your television set and a cassette recorder.

The speed of a business micro.

Some home computers respond pretty slowly to your commands. After you've pressed the keys, they leave you twiddling your thumbs for more than a mere few seconds.

The plodders, however, are a very long way behind the Electron.

In fact, on processing speed, a recent bench test survey ranked the Electron up with such high fliers as the IBM PC and the Apple 111. Both are machines which cost well over £1,000.



It's an astonishing accolade when the Electron makes no greater claim than to be a micro which is designed to become part of the family.

Your starter for free.

With your Electron, you'll receive a free introductory cassette.

It will give you a taste of the exceptional colour graphics. It will show you how the Electron can play and notate music.

And when it's given you some new ideas about home accounting, it will challenge yo to a few games and even spend few seconds doing your whole family's biorhythms for you.

But remember, although holds 15 programs, the cassette wi only give you a glimpse of the Electron's full potential.

Because the potential is as infinite as your own imaginatior

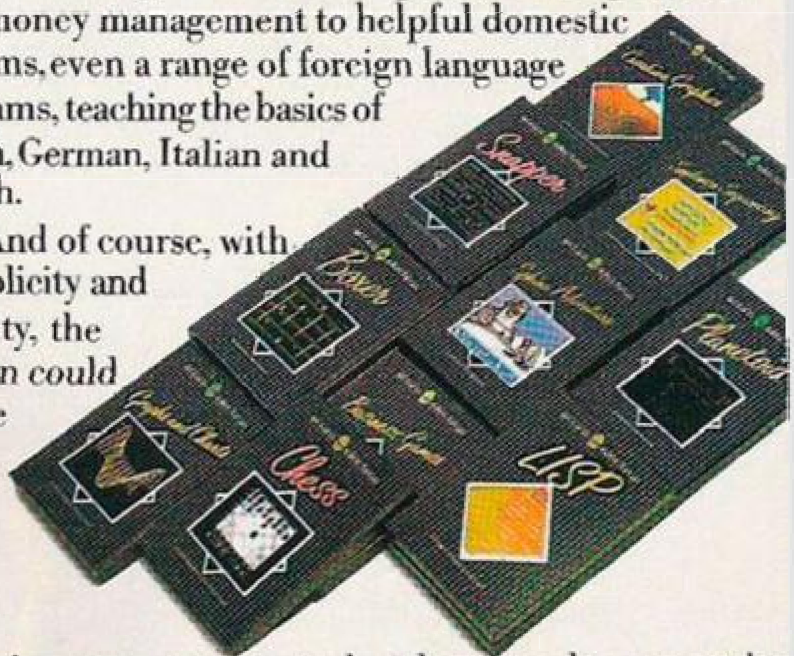
No shortage of software.

Although the Electron is still a relative newcomer to the market, the range of softwar available for it is considerable.

Besides plenty of games, there are many educational programs for children of all ages, from playschoc to A Level.

There's a great deal to keep adults occupied, too. From money management to helpful domestic programs, even a range of foreign language programs, teaching the basics of French, German, Italian and Spanish.

And of course, with its simplicity and flexibility, the Electron could soon be processing programs created and written by none othe than yourself.



You can find the Acorn Electron with its full complement of accessories and software at local Acorn dealers and major high street stores.

For the address of your nearest supplier, ring 0933 79300.

The Acorn Electron

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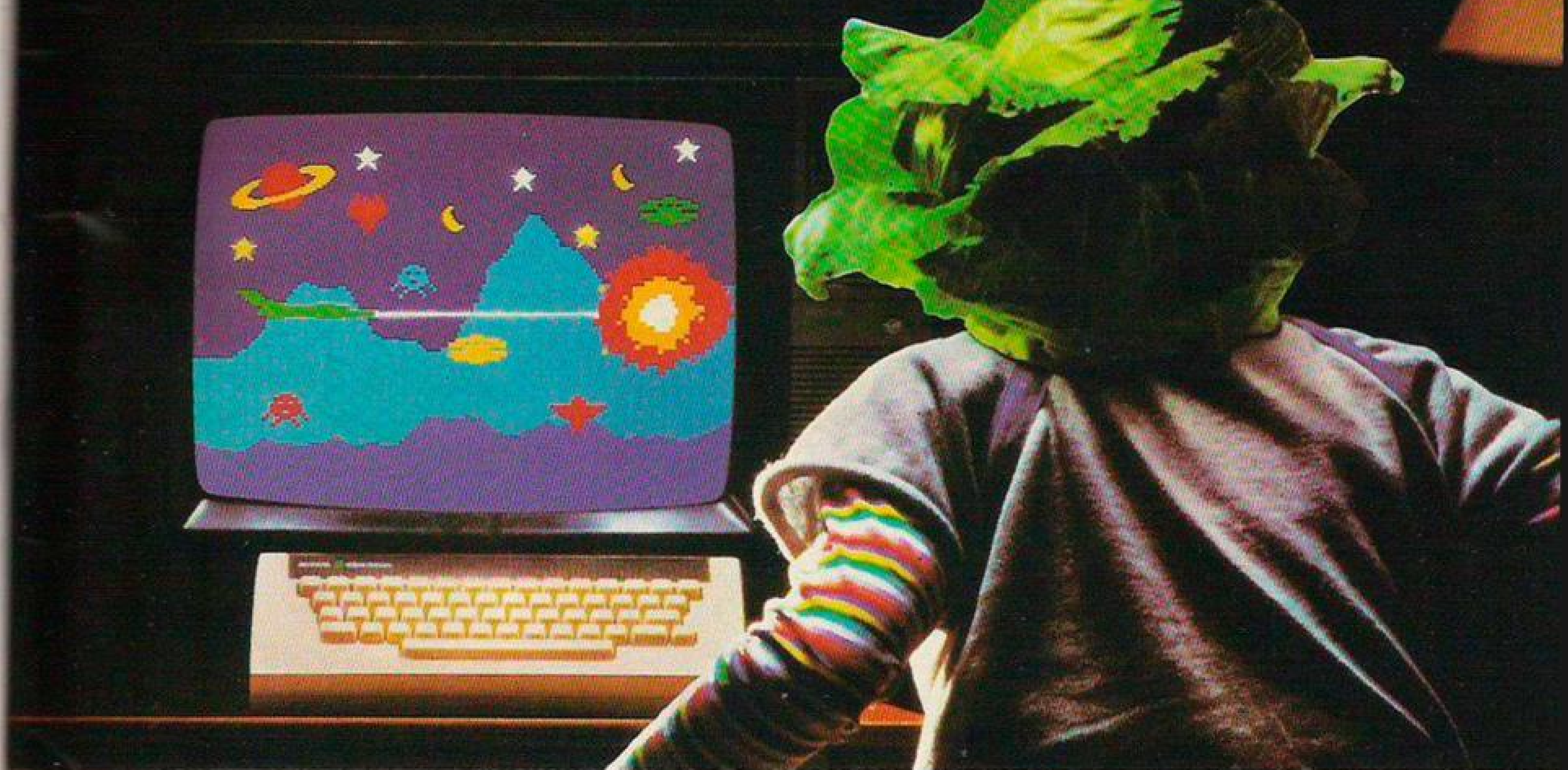

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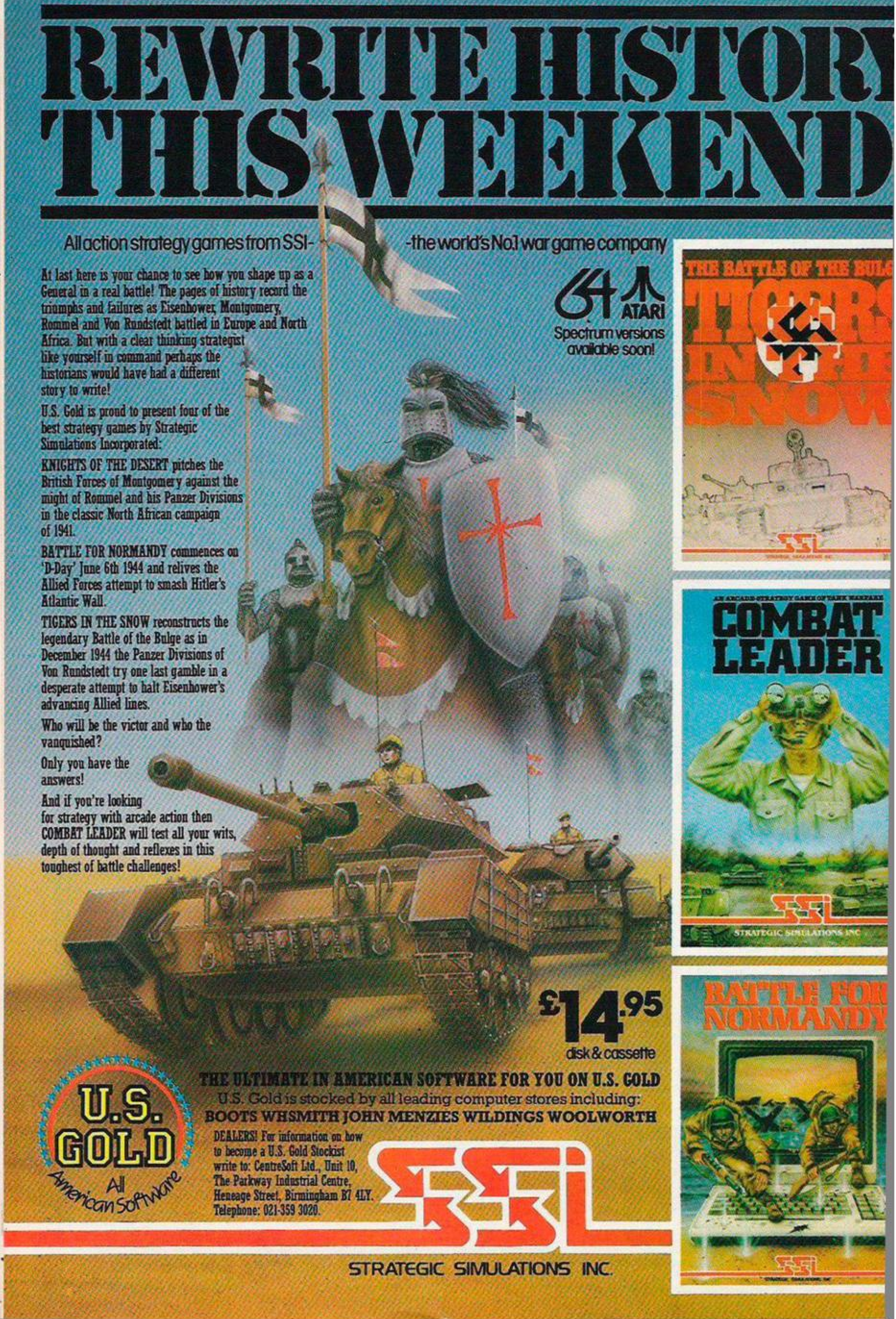
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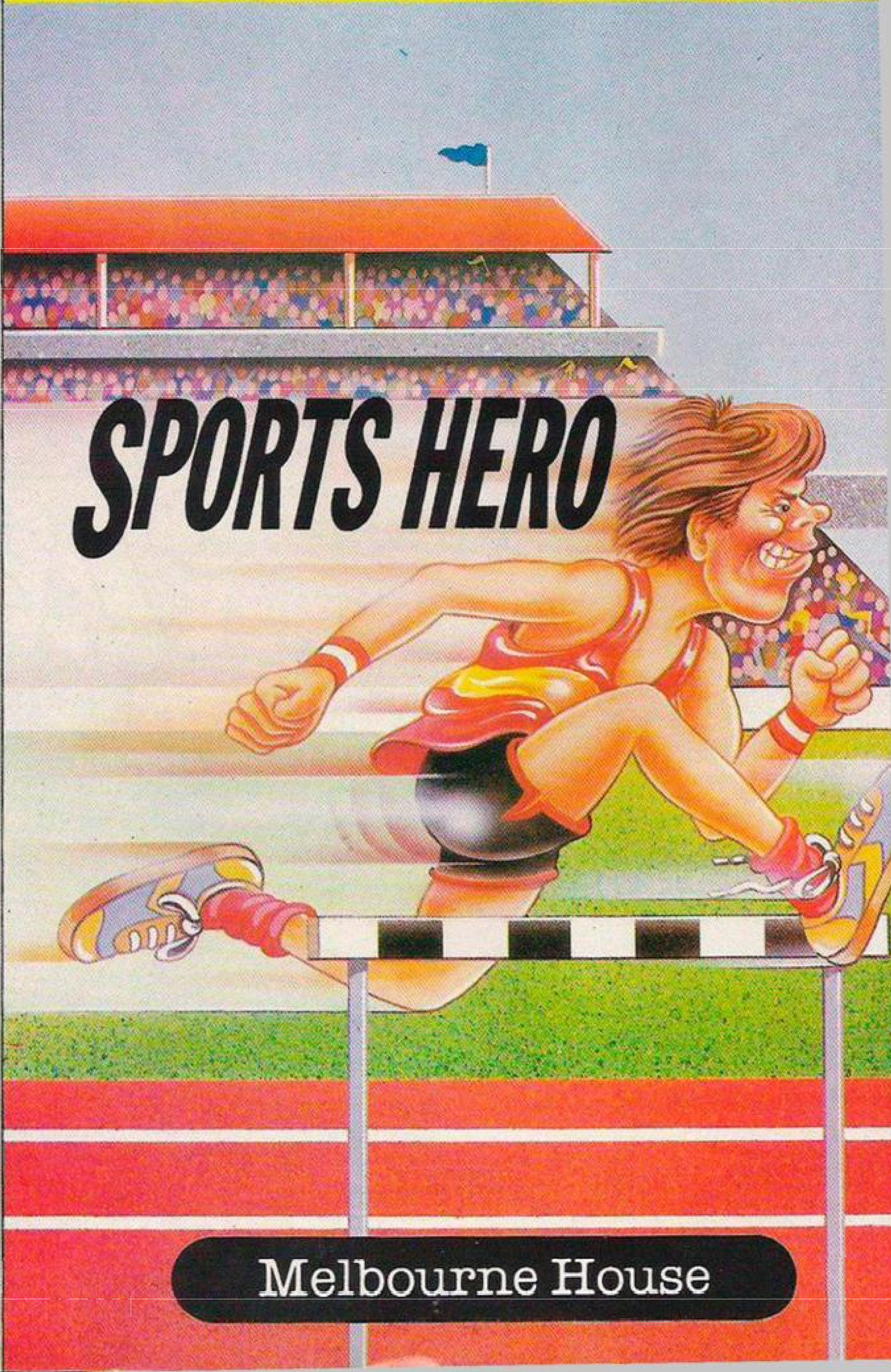

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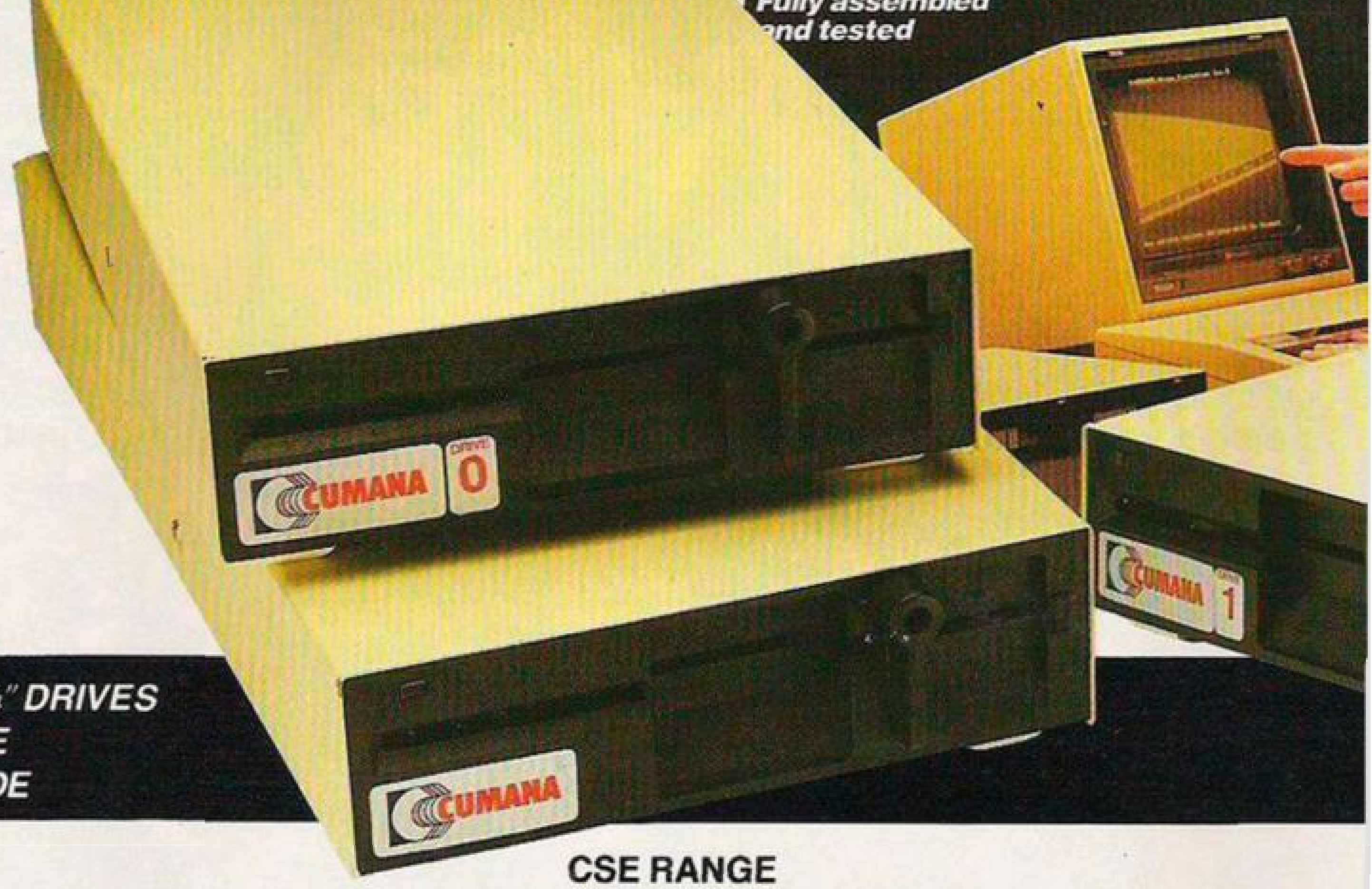

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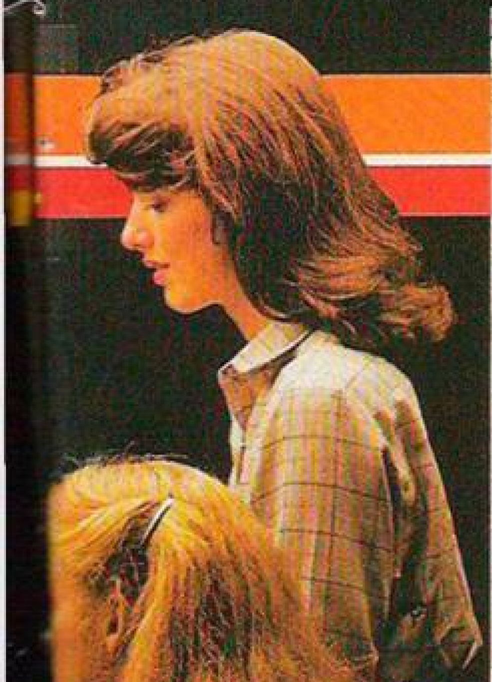

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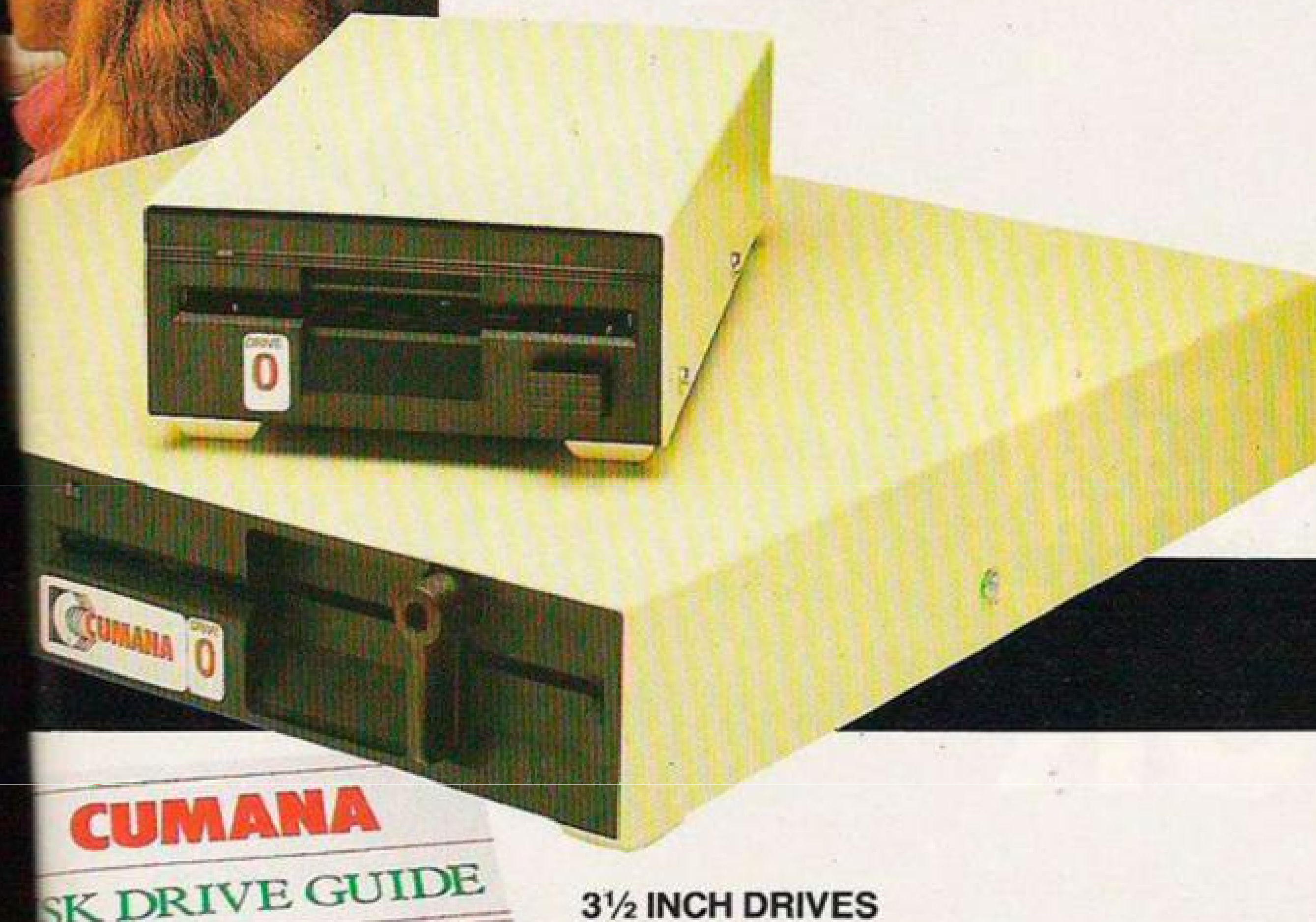

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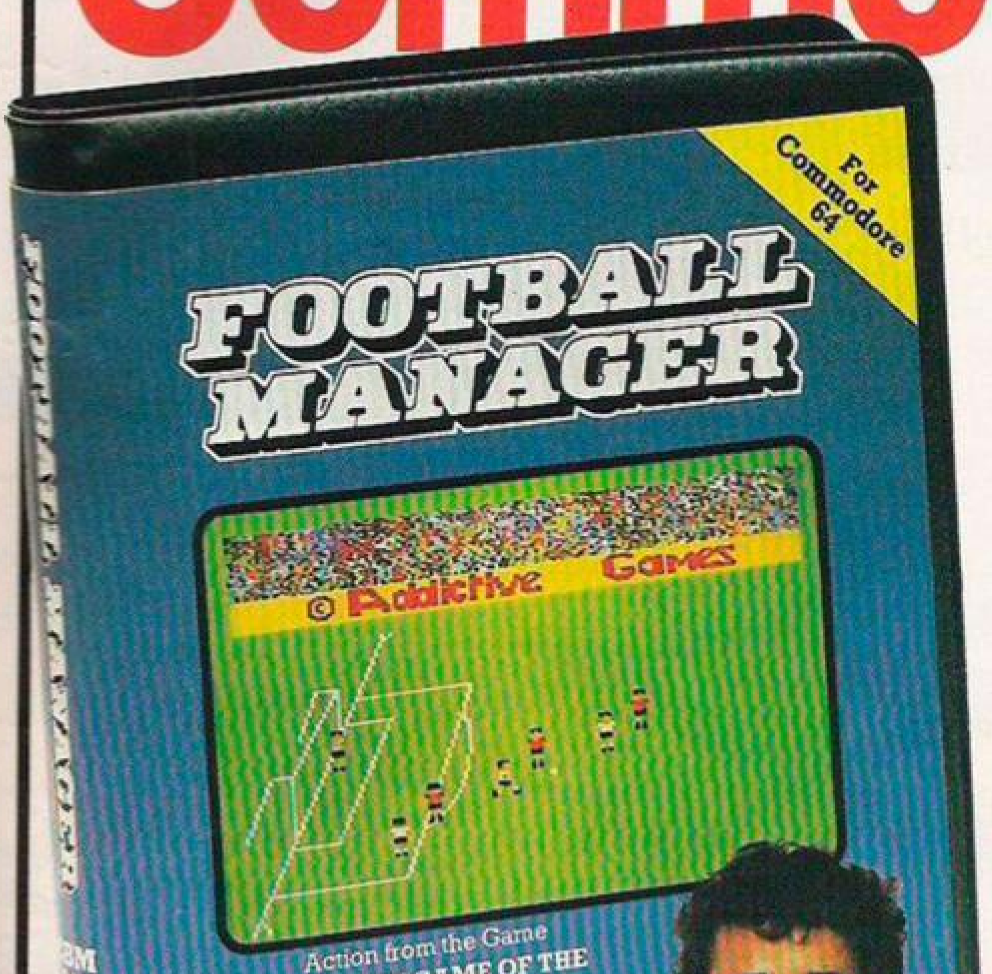

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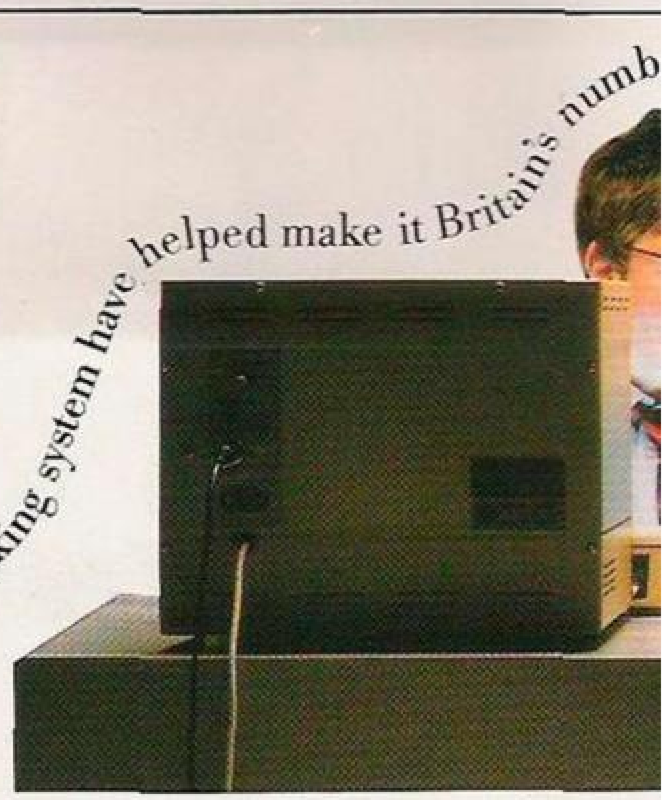

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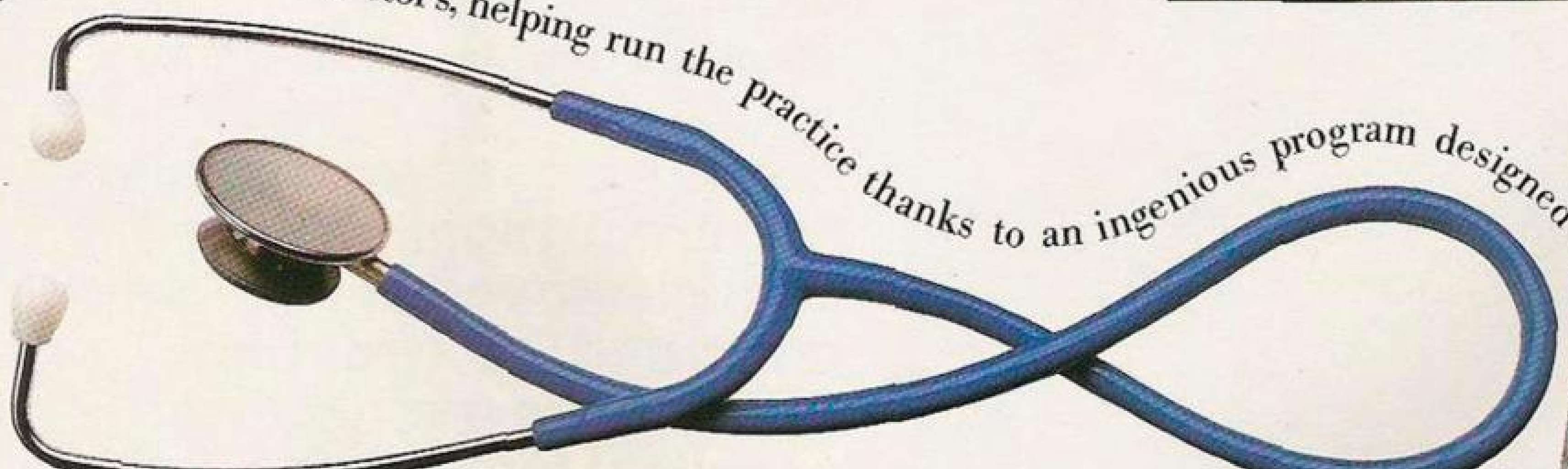

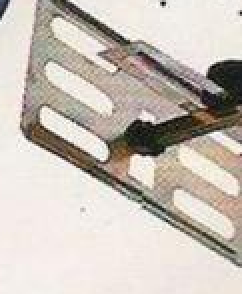

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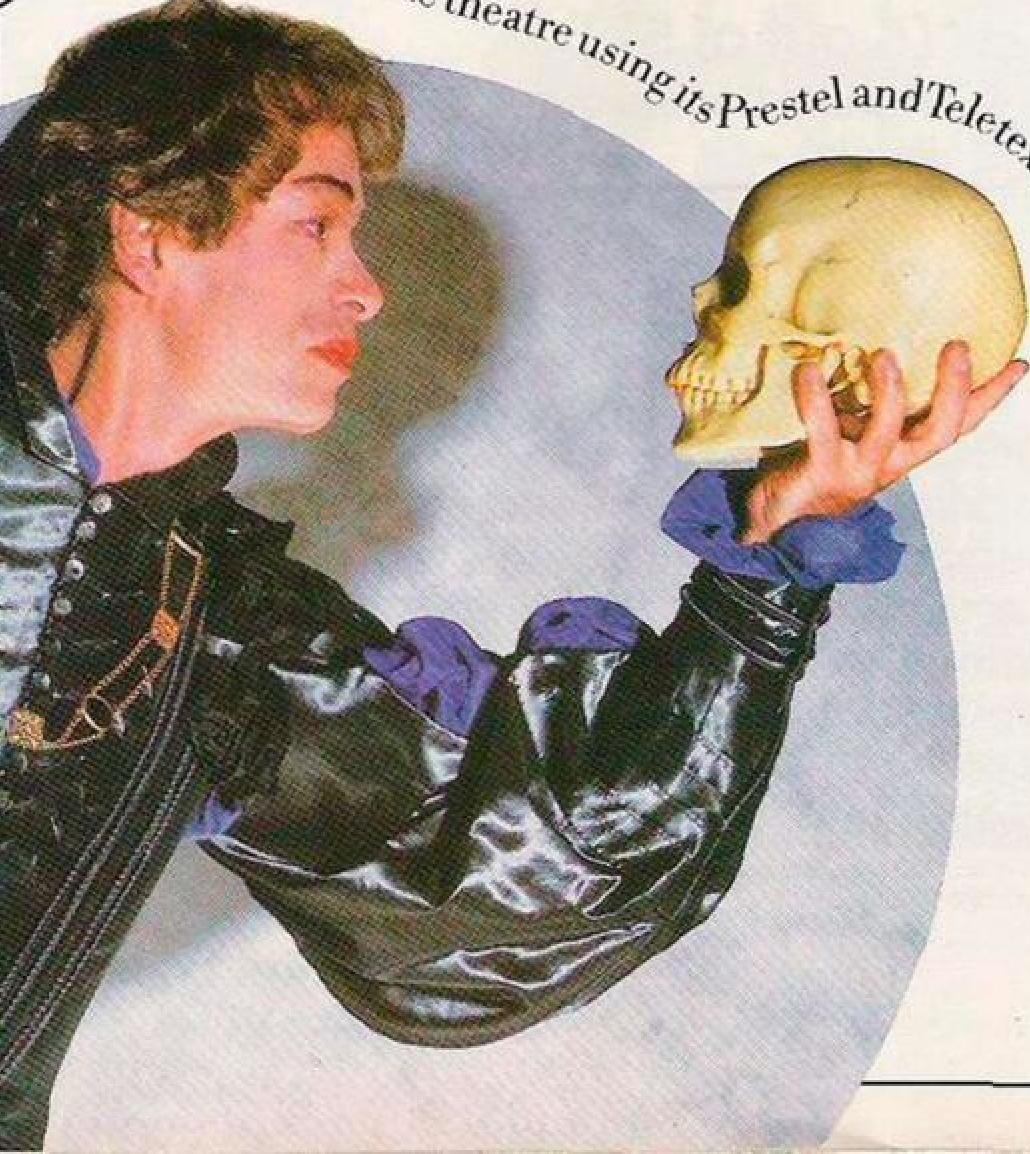

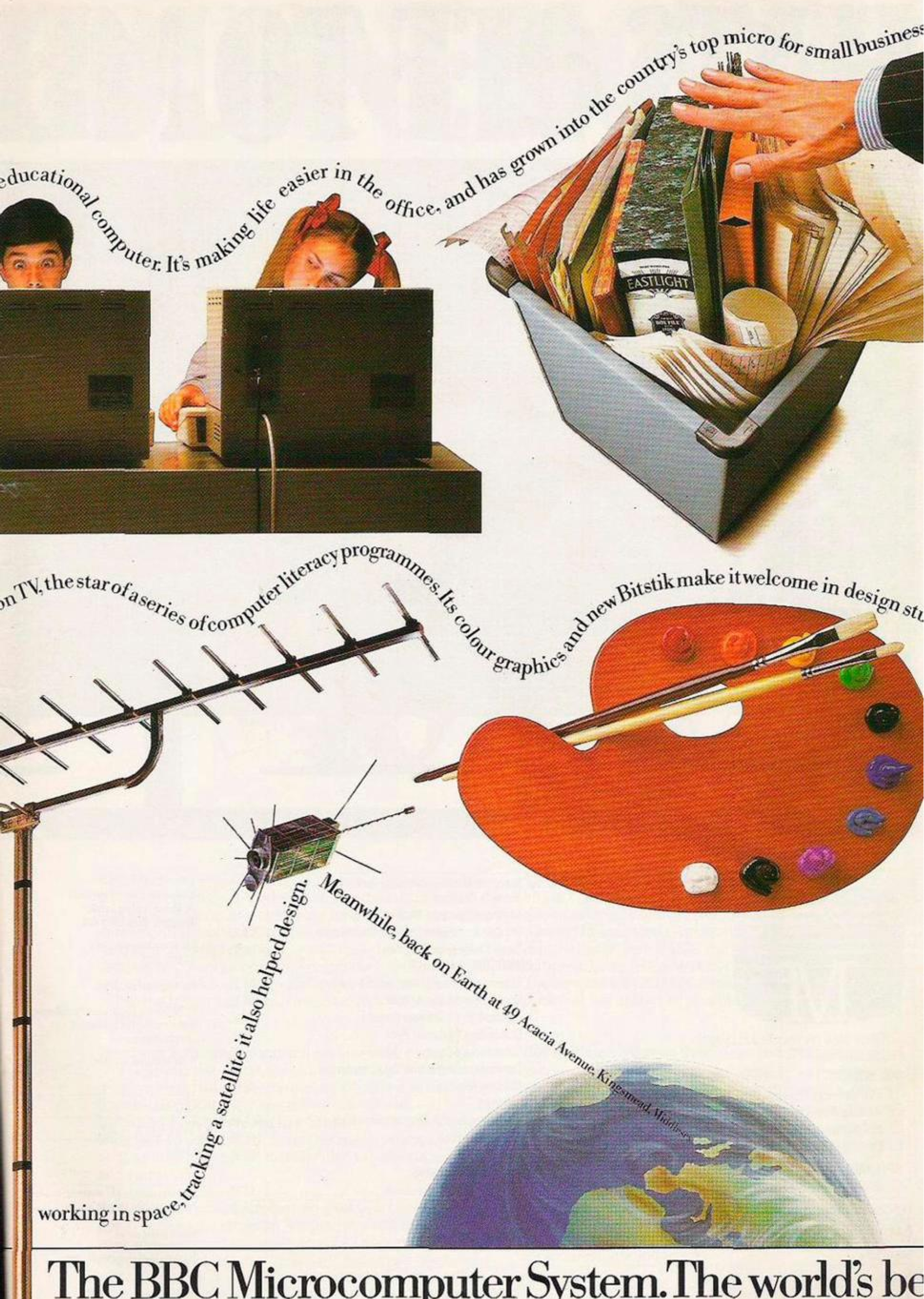

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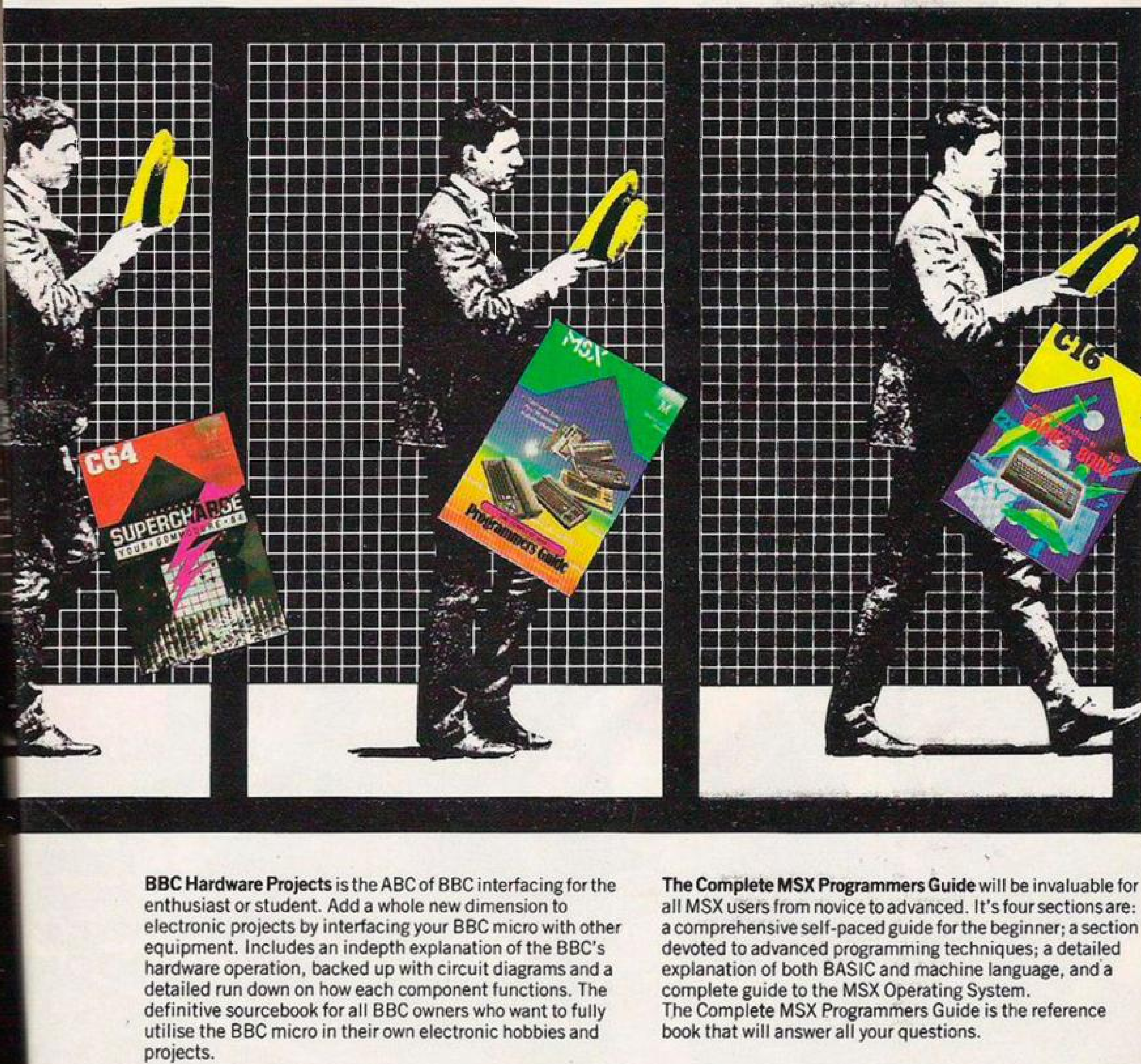

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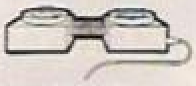

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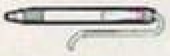

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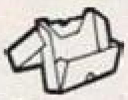

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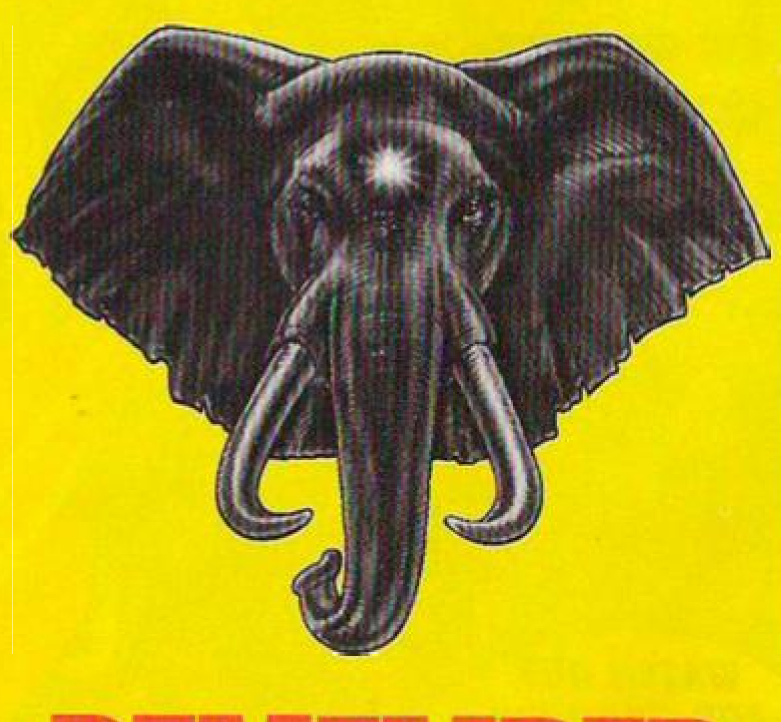

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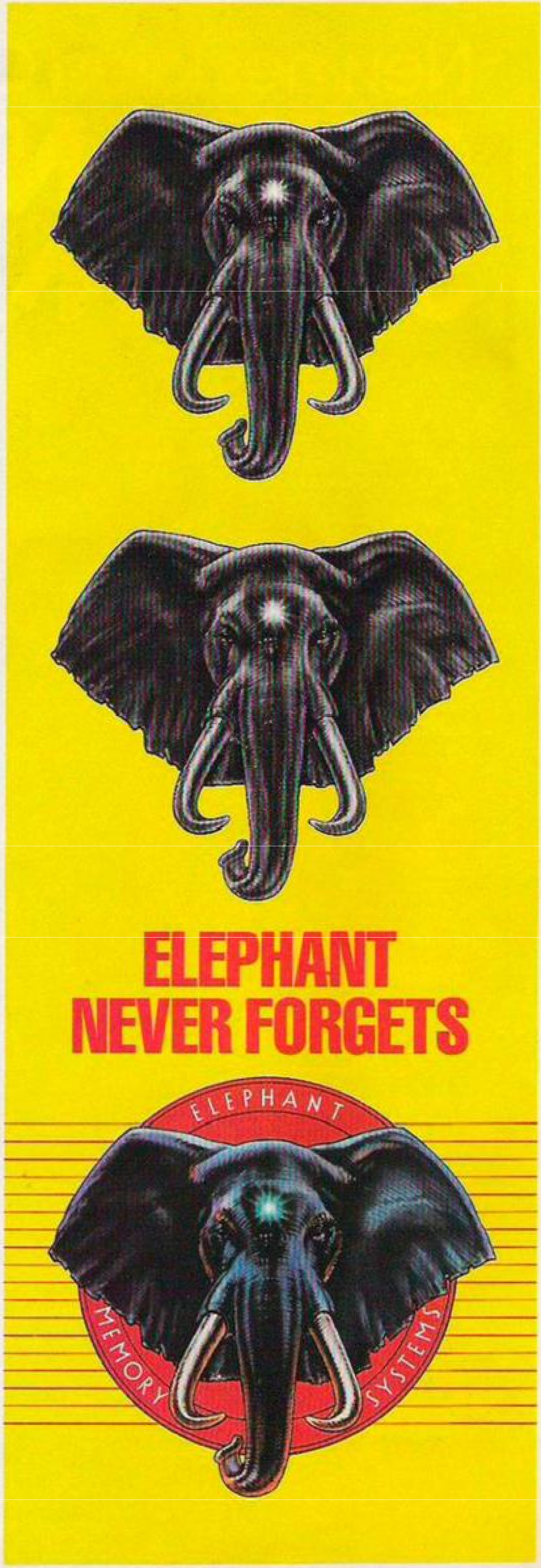

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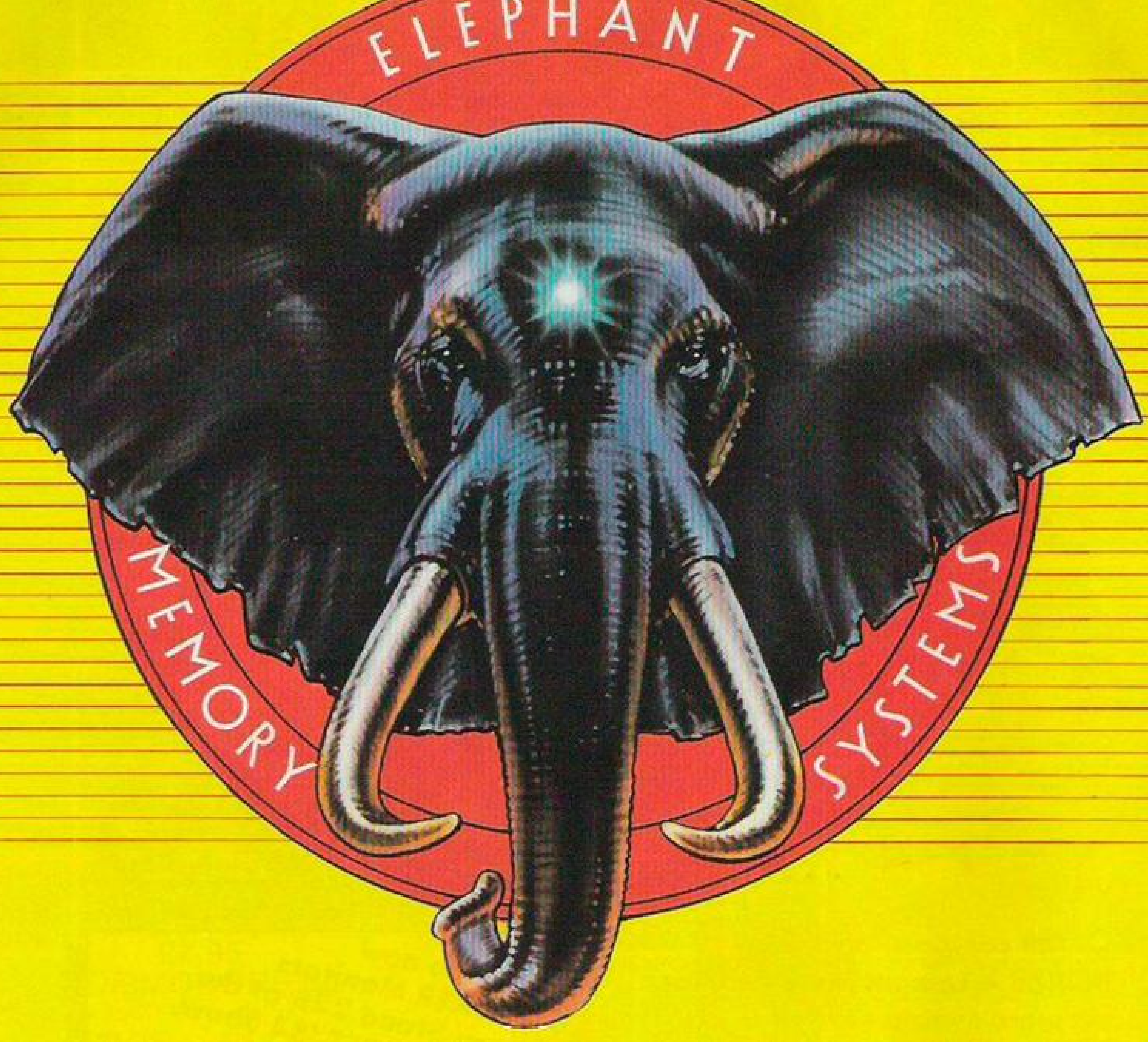

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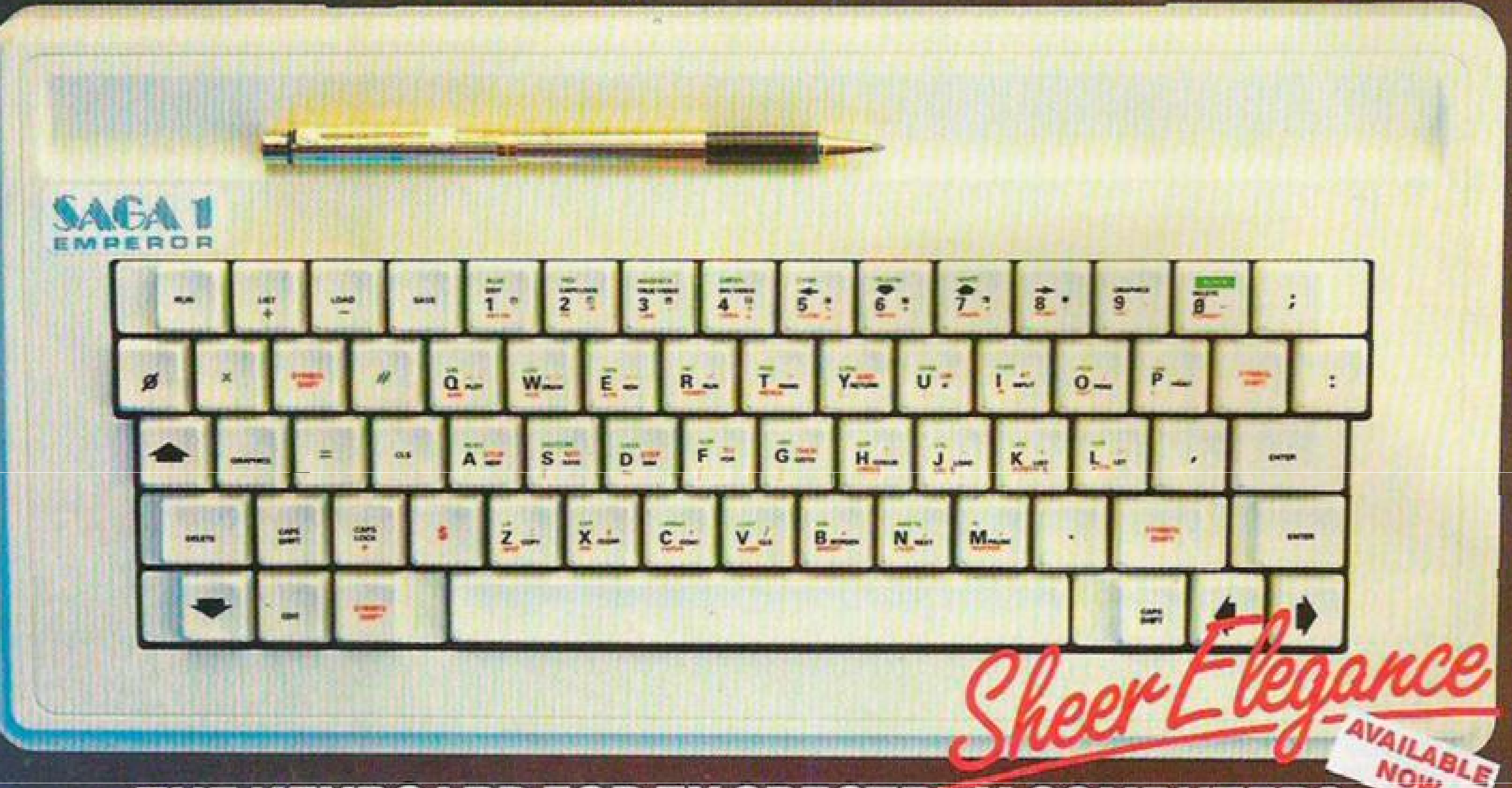

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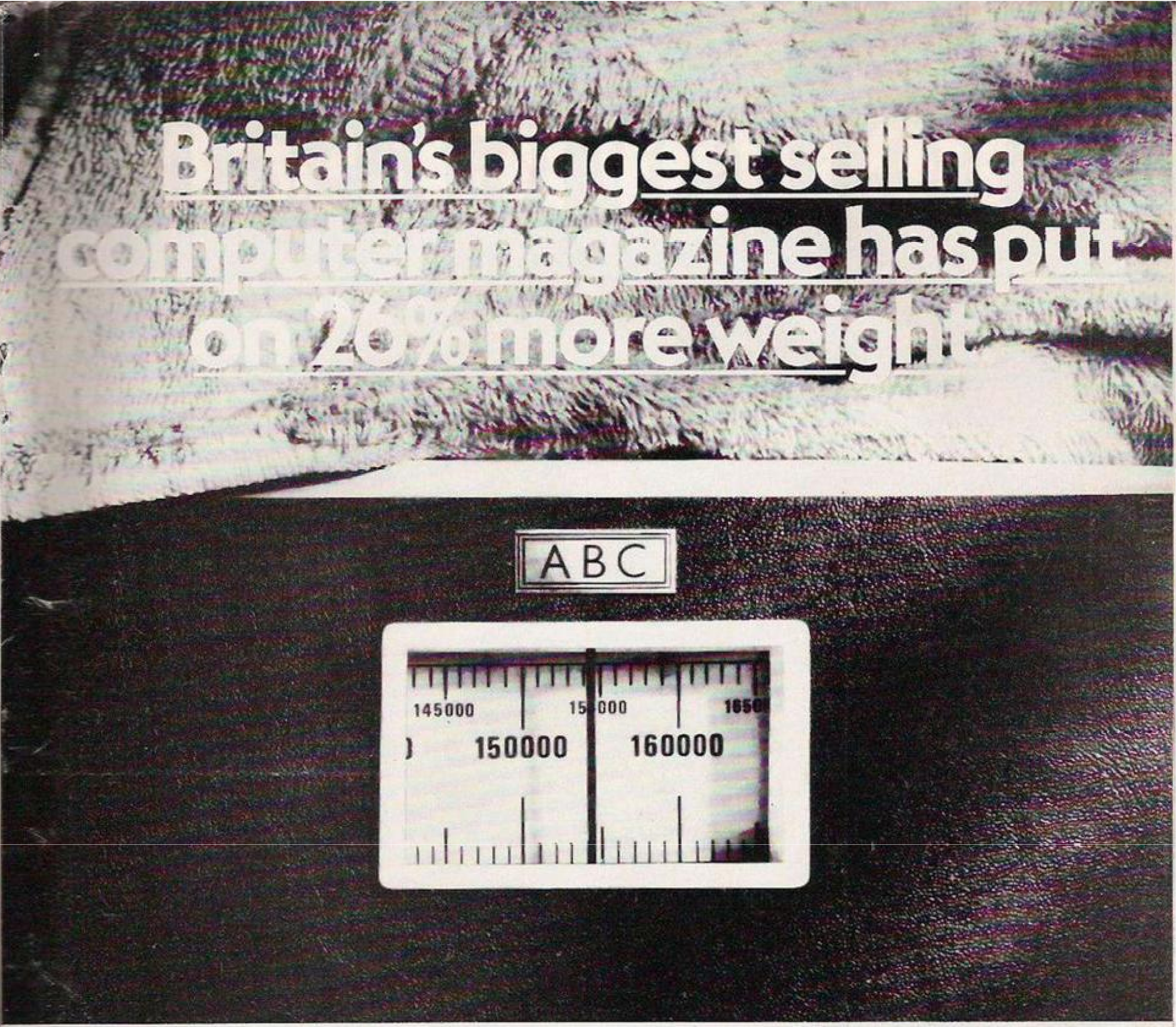

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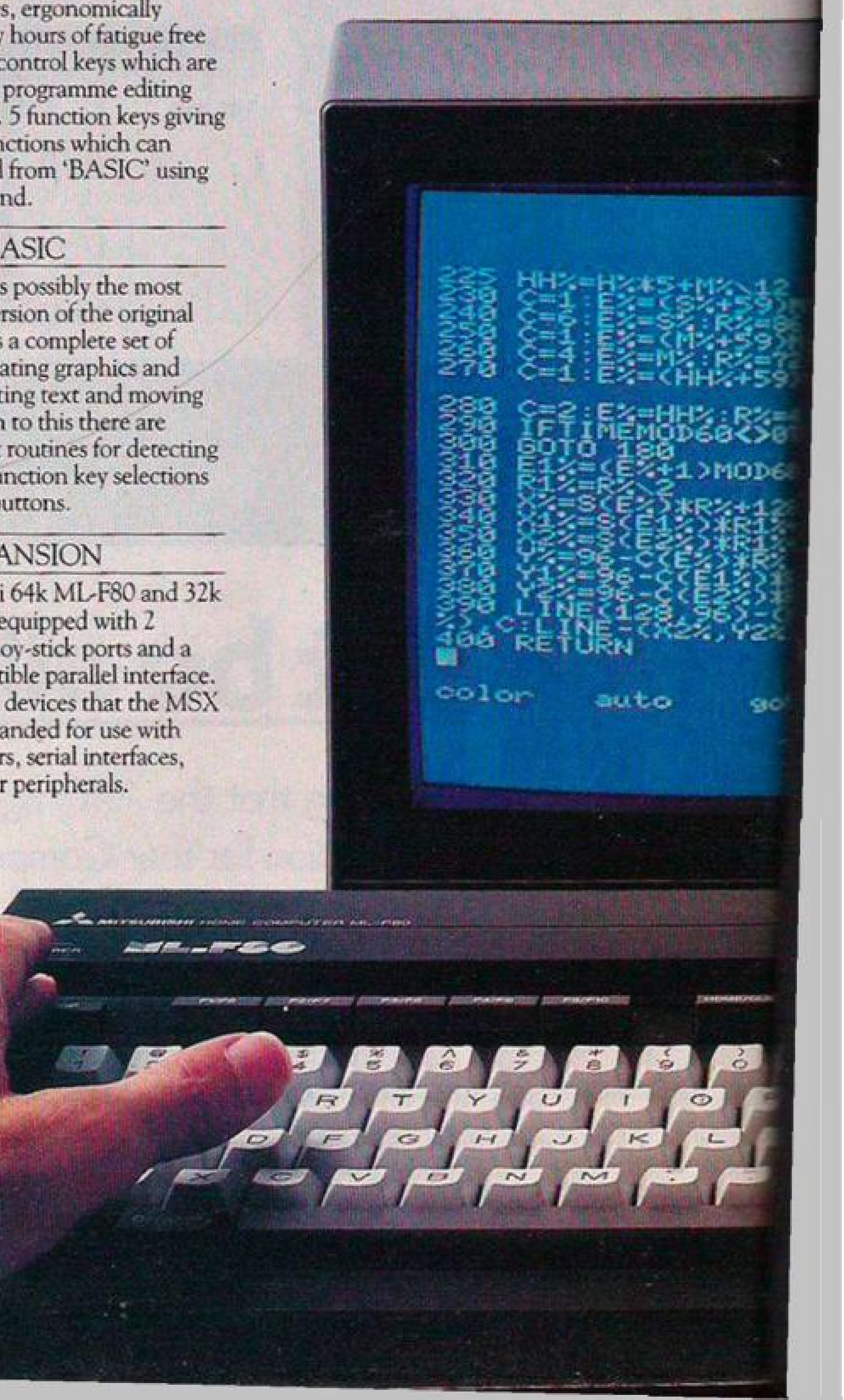

i MSX Computers

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*Graphics:
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Sprites: 32
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ML-F80

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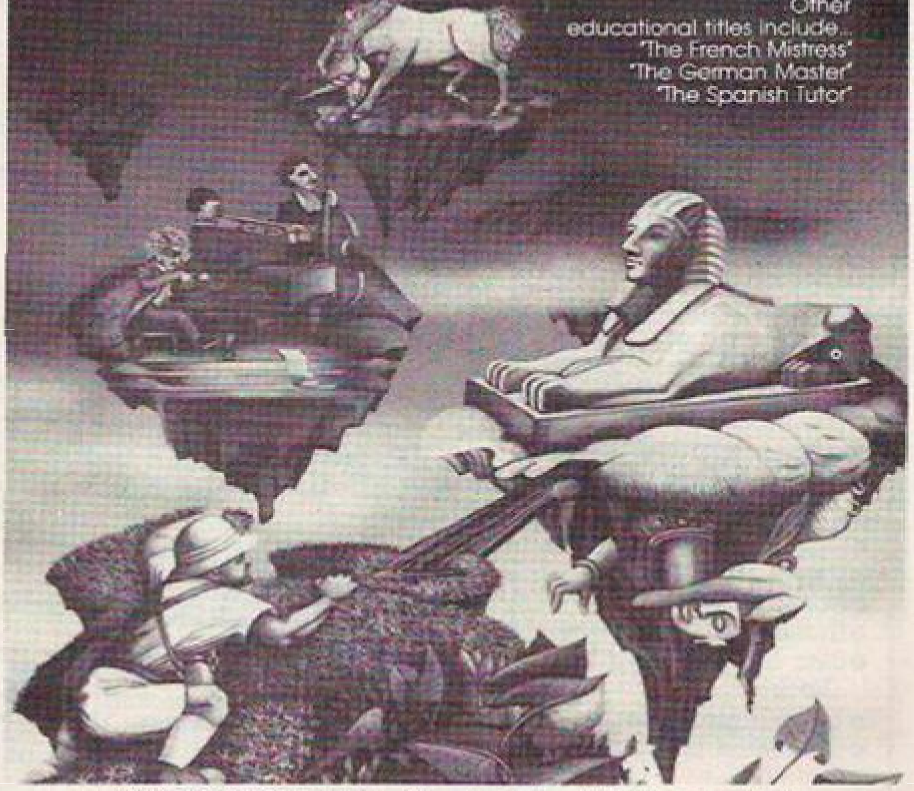

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Linage advertisers should complete the form provided in BLOCK CAPITALS. Phone number counts as 2 words. Name and address to be paid for if used in advertisement. Box Number if required is £4.00 extra.

Display — rates per scc (Min 2scc)

One insertion	£9.00
Three insertions	£8.70
Six insertions	£8.50
Twelve insertions	£8.00

Display advertisers should provide separate copy and preferably reserve space by phone (01-661 3036).

Method of Payment

Cheques etc, should be made payable to Business Press International Ltd, and crossed. I enclose herewith cheque/PO for

£ ....

Please debit my Access/Visa Barclay Card/American Express/Diners Club International as below

SIGNATURE

Post to:

Cut out the order form and return together with your remittance to: Classified Department, Your Computer, Room H211, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. (01) 661 3036

Please insert the following advertisement in Your Computer Classified Section

					LINAGE
					£10.00
					£12.50
					£15.00
					£17.50
					£20.00
					£22.50
					£25.00

No. of insertions required ☐ Box No. required YES/NO

NAME *(Please include initials)* ....

ADDRESS ....

....

....

Payment by credit card please state address card is registered

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THIS FORM SHOULD BE RETURNED BY 26th NOV. FOR JAN. ISSUE PUBLICATION

Company Registered Number: 151537 (England) Registered Office: Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Hot★lines

Acorn Computer
Telephone: Cambridge 0223-245200

Atari
Telephone: Slough 0753-24561

Amstrad
Telephone: Brentwood 0277 228888

Camputers
Telephone: Cambridge 0223-315063

Commodore CBM
Telephone: Slough 0753-74111

Sharp
Telephone: Manchester 061-2052333

Sinclair
Telephone: Cambridge 0276-685311

Tandy Corporation
Telephone: Birmingham 021-5566101

Toshiba
Telephone: Camberley 0276 62222

DATEBASE

Local, national and international micro events are updated here. To publicise your event, phone Paul Bond on 01-661 3472.

Hi-Technology and Computers in Education Exhibtion

Deals with everything from humble BBCs to big DECs and their application in education. Takes place at the Barbican from 23-26 January. Details from Computer Marketplace 01-930 1612.

East Midlands Computer Show

From November 27 until December 2 at the East Midlands Conference Centre, Nottingham. For more details telephone Central Exhibitions on 0827 896474.

Andy Andrews and John Wise — respectively chairman and managing director, Dennison Manufacturing Co. Ltd., and sales and marketing manager, Dennison Computer Supplies Division — in last minute, top level consultation prior to introducing the range of Elephant Memory Systems floppy discs to users in UK.

Electron and BBC Micro User Show

Everything for the Electron and BBC Micro user, in this exhibition at Alexandra Palace, London. From December 6 to December 9 at the New Horticultural Hall, London. Telephone Database Publications on 061 456 8383.

INDEX OF ADVERTISERS

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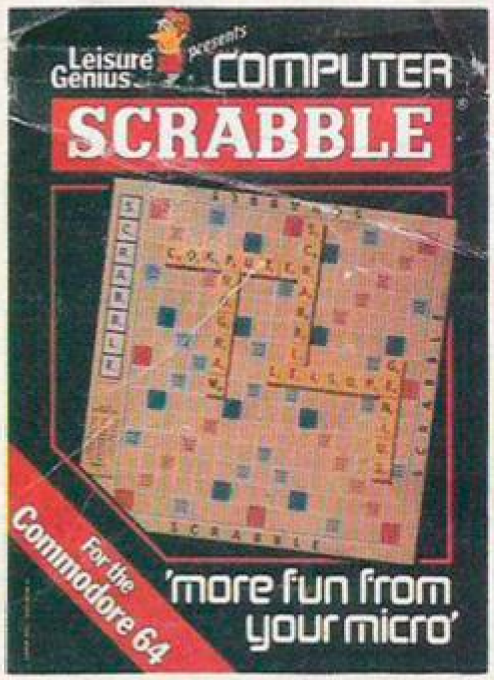

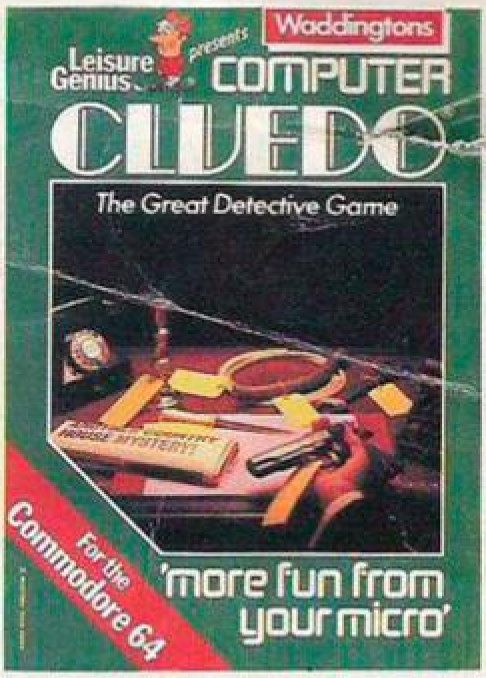

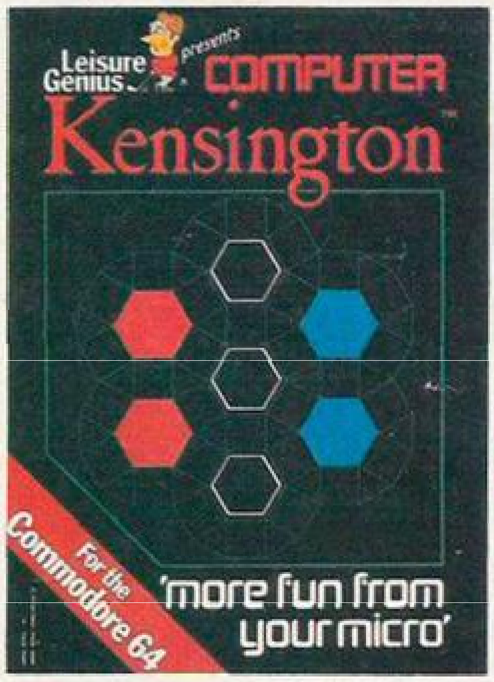

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The interface comprises a speech synthesizer and a powerful stereo amplifier. The speech synthesizer uses the popular SLO/256 speech chip and has an almost infinite vocabulary. It is supplied with a text to speech converter for ease of speech output creation. Everything you wish to be spoken is entered in normal English, without special control codes or characters, it is therefore extremely easy to use. The voicing of the words is completely user transparent and the computer can carry on its normal running of a program while the speech chip is talking. The speech output from the SLO/256 is mono and directed to both speakers.
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